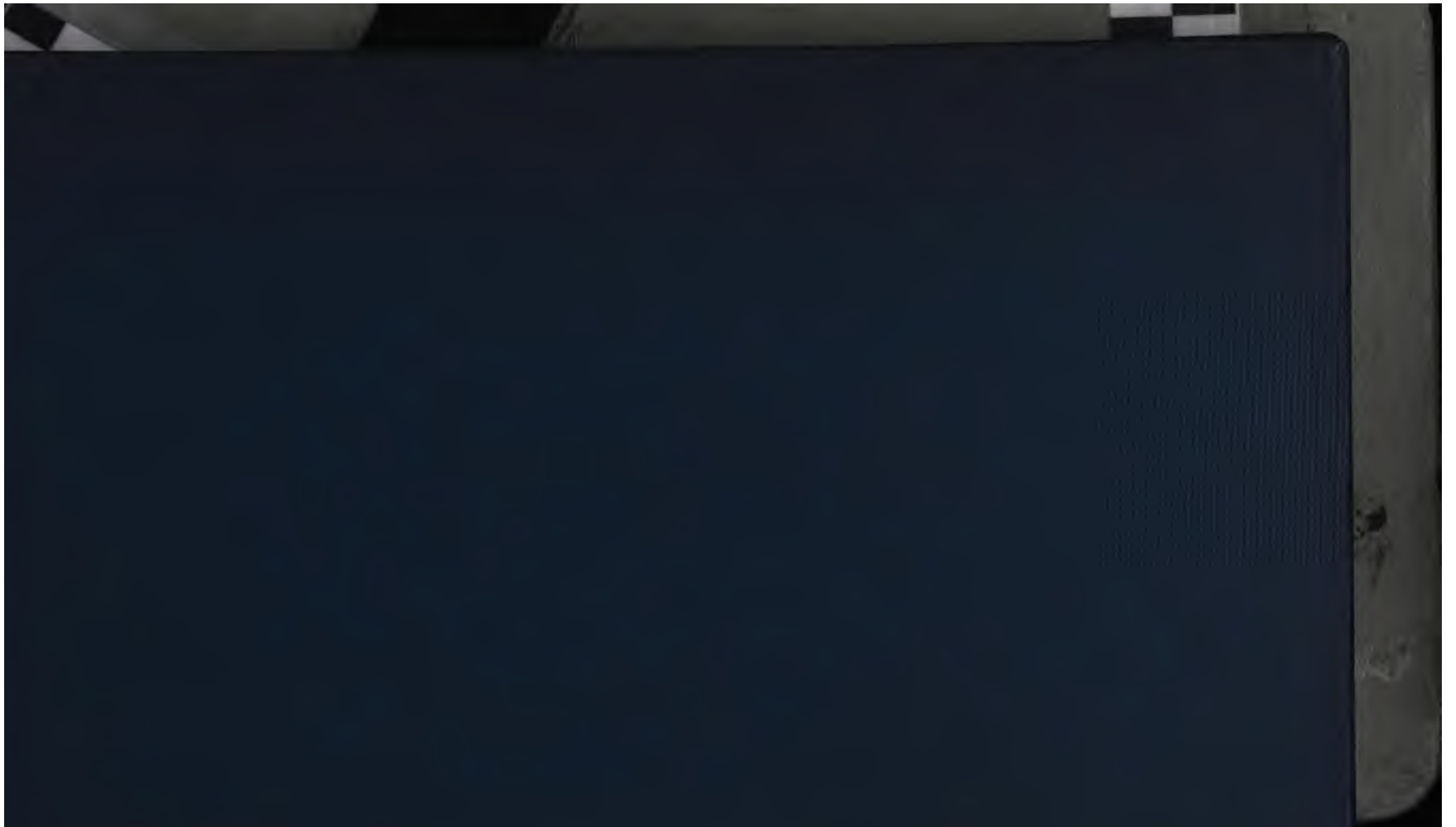

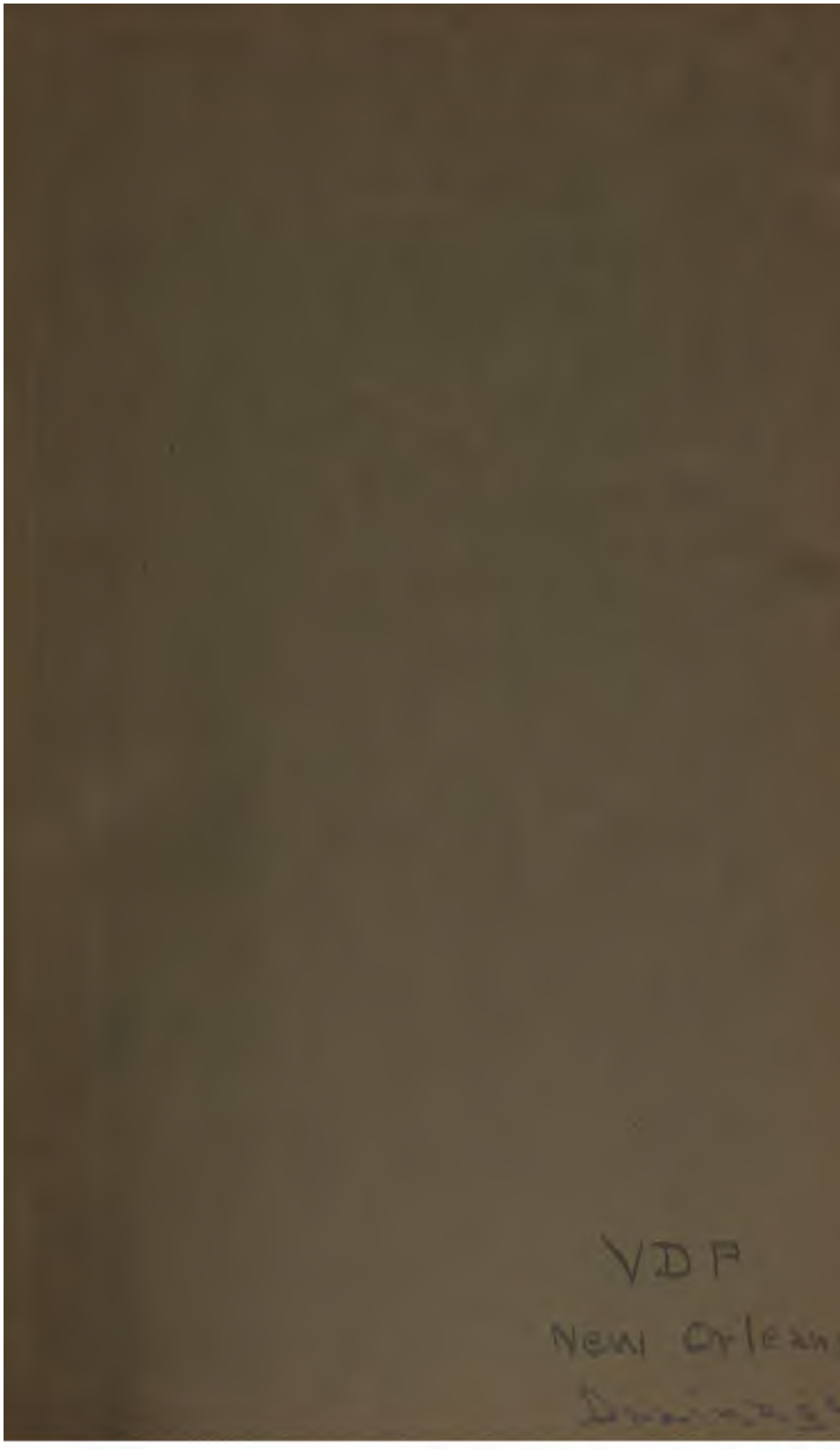
VDP
New Orleans

REPORT

BOARD OF INQUIRY

ON THE

CONDUCT AND CHARACTER OF THE DRAINAGE WORKS,

NEW ORLEANS, LA.

RUDOLPH HERING, C. E.
GEO. H. BENZENBERG, C. E.
HOWARD A. CARSON, C. E.

MARCH, 1902.

C. W. CORSON, STATIONER, 740 UNION ST., N. O.

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CONTENTS.

PAGE.

Report of Board of Inquiry 3

APPENDIX I.—Papers submitted to the Board by the Drainage Commissioners 21

APPENDIX II.—Correspondence with Mr. E. W. Brown 37

APPENDIX III.—Oral Testimony and Exhibits 42

EXHIBIT A.—Specifications for Steel Portland Cement 124

" B.—Communication from Capt. Venable 130

" C.—List of Changes of Location and Alignment 135

" D.—List of Works Completed and Unfinished 136

" E.—Old and New Sections of Small Canals 139

" F.—Copies of Bids on Portland Cement to U. S. Government and Specifications (1896 to 1906) submitted by Mr. E. W. Fisher 140

" G.—Various Papers submitted to Board of Inquiry 153

" —Cement Tests, Laboratory of City Engineer ..... between 162 and 163

" —Width of Canals 180

REPORT OF BOARD OF INQUIRY.

NEW ORLEANS, LA., March 25th, 1902.

To the Honorable Board of Drainage Commissioners of New Orleans:

Gentlemen:

The undersigned, appointed by you, met in New Orleans for the purpose of entering upon the duties assigned them in pursuance of the following resolutions adopted by your Honorable Board:

"WHEREAS, Upon the occasion of the withdrawal from the service of the Drainage Commission of New Orleans, in which he has been so long engaged, of Chief Engineer, B. M. HARROD, the request made by him for an investigation and report upon the work done under his professional control, ought to be allowed.

"*Be it Resolved*, That MESSRS. RUDOLPH HERING, GEORGE H. BENZENBERG and HOWARD A. CARSON, Civil Engineers, be appointed to examine the work in question, to ascertain and report whether or not it has been carried on as it was designated and developed in the deliberations of the scientific engineers engaged, in the ordinances of the Mayor and Council, and in the general and special specifications on the subject which have the sanction of public authority; and if there have been any departures from the system so established out of consideration of public policy, that they be reported as soon as practicable, together with the reasons for making them.

"*Resolved*, That the engineers appointed be further directed to report at the same time upon the character of the drainage work which has been done and upon the nature and qualities of it, as regarding the time in which it has been constructed, the materials which have been used, and the probable duration and efficiency of the work for the great purpose for which it has been undertaken.

"Resolved, That said engineers are requested wherever it is

practicable, and in their judgment desirable, to send for persons and papers."

On the afternoon of March 14th, at the Committee Room of the office of the Sewerage and Water Board, No. 602 Carondelet Street, your President, the Honorable R. M. Walmsley, addressed the undersigned as a Board of Inquiry, and presented to them the following instructions and documents for their guidance and joint consideration:

1. A copy of the following resolutions adopted by your Board:

"RESOLVED, That the Board of Engineers appointed to make inquiry under resolutions of this Commission, adopted February 20th, be requested to conduct its investigations, so far as practicable, in a public manner, and that any person having anything to submit within the scope of the above resolutions be invited to present such matter to said Board of Engineers, at such time or times as the Board may indicate; also that the Commission respectfully requests that any person or persons called on by the Board of Engineers in connection with the investigation, be asked to promptly respond."

2. A copy of the following letter:

FEBRUARY 10th, 1902.

MR. R. M. WALMSLEY, President,
The Drainage Commission of New Orleans, City.

Sir:

I have the honor to suggest, through you, to the Drainage Commission, that Mr. H. B. Richardsan and Mr. Rudolph Hering be requested to make examination and report on the manner, both as regards design and construction, in which the plan of drainage has thus far been carried out, and on any other matters which appear to them to bear on this subject. You will recollect that these engineers, with myself, composed the Engineering Committee of the Advisory Board, under whose examination and approval the plan was prepared.

Very respectfully,
(Signed) B. M. HARROD,
Chief Engineer.

Also copies of a letter from Mr. L. W. Brown to Mr. R. M. Walmsley, dated August 2nd, 1901; of an address and letter presented at a regular meeting of the Progressive Union, held August 5th, 1901; of a letter from the President of said Union to Mr. R. M. Walmsley, dated August 6th, 1901, transmitting copy of a resolution adopted at said meeting; of a statement submitted by the chairman of the Executive Committee and the Chief Engineer of the Drainage Commission, on August 28th, 1901, in answer to said resolution; of a letter to the *Times-Democrat* by Mr. L. W. Brown, under date of February 8th, 1902; of reports submitted by a Special Committee and by the Chief Engineer of the Drainage Commission, on February 5th, 1902; of the original plans and specifications made subsequently thereto, as well as a copy of the Ordinance No. 10,991, C. S., approving said plans, under date of July 10th, 1895, and of the legislative Act No. 114 of 1896, creating the Drainage Commission with power to carry out substantially the plans as approved; all of which, except Act No. 114, are found in Appendix I, hereto attached.

The undersigned, as a Board of Inquiry, immediately began to hold their public sessions and to familiarize themselves with all of the above documents. Letters were sent out to all parties supposed to be competent to give evidence or information upon the matter under investigation. To give notice that the Board desired to hear all persons who might have any knowledge on the subject, the following was published in the daily papers, viz:

SPECIAL NOTICE:

The Board of Engineers appointed to inquire into any departure from the plans or character of the work as authorized to be carried out by the Drainage Commission, in accordance with the report by the Advisory Board in 1895, request that any person having any knowledge of any such departure from either plans or specifications, appear before it at its public meeting, to be held at the office of the Sewerage and Water Board, No. 602 Carondelet Street, at 2 P. M., Saturday, March 15th, 1902, and present such information and data as they have at that time.

(Signed) RUDOLPH HERING,
G. H. BENZENBERG,
H. A. CARSON.

Constant efforts were made to secure all the reliable information possible, to give all parties interested full opportunity to be heard or to submit any facts bearing on either side of the investigation, and further public notice was given.

All persons, but one, who were mentioned as having some knowledge on the subject, responded promptly to our request and gave us such information as they possessed.

We were greatly disappointed by Mr. W. L. Brown's repeated refusal to call, as we expected, that from his long and intimate connection with the work from its inception, and because of his numerous public criticisms, his condemnation of the work and his prophecy of its failure in both stability and efficiency, he was in a position to point out to us the various ways in which the work departed from the plans and specifications of the drainage system of 1896, so as to merit the severe and unqualified criticism it was receiving. His testimony would have undoubtedly facilitated our investigation by enabling us to ascertain at once whether alleged disastrous changes have taken place.

The correspondence between Mr. Brown and the Board is hereto appended.

A stenographic report of all the oral testimony and information given was preserved for reference, and it, as well as all papers, statements and maps submitted with such testimony are hereto attached.

Copies of all specifications and plans for the various parts of the drainage system, either completed or under process of construction and of records in the office of the Chief Engineer were promptly and cheerfully furnished us on request. These and the papers submitted by the various witnesses were carefully examined and discussed between and since our public sessions.

We also, at different times, visited Pumping Stations Nos. 1, 2, 3, 6, and the Central Power Station. We also visited the completed section and covered canals of the drainage system on St. Charles Avenue, east of Washington Avenue; on Julia Street, west of St. Charles; on Canal Street, west of Royal Street; on Basin, Claiborne and Galvez Streets, west of Canal Street; on St. Louis Street at Claiborne; on Chartres, north of Canal Street;

and on Constance and Julia Streets to Magazine Street. We entered all of these canals and in nearly every case, except in a few instances where the depth of the water was more than two and a half feet, we walked through quite a length of such canals, carefully making personal examinations of the character of the material and workmanship, as well as of the alignments, connections, their general condition and operation.

We also visited the work now in various stages of construction, on Third Street south of St. Charles Avenue; on Constance Street east of Third Street; on Perrier Street and Nashville Avenue; on N. Caliborne Street between Esplanade and St. Bernard; and on the latter south of Claiborne Street. At each place we examined the character of the soil, work and material, as well as noted the difference in construction made necessary because of the condition of the soil or because the change was thought to be more economical in stability of structure.

On March 20, after having concluded our public meetings and the taking of testimony, we again examined and compared the various plans, computations and specifications, and after a careful deliberation and consideration of all the facts which have come to our knowledge, we present the following report upon the subject matter referred to in your resolutions:

The first of these requests us, after examining the work in question, to report whether or not it has been carried on, as it was originally designed, and if there have been any departures from the system, to report such, together with the reason for making them.

The general plan and specifications which were prepared by a Board of Advisory Engineers in 1895, provided for a general drainage system for the entire area of the City of New Orleans, and outlined its special features and located the various pumping stations, out-falls and the different main and branch canals and drains in a general way. This system was approved by the Common Council, and the Legislature by enactment established the Drainage Commission and empowered it "to execute and carry out substantially the plan for such drainage, adopted by the Council of said city" * * * so far as it may find said plan de-

[illegible] modify the [illegible]

It was [illegible] was practicable [illegible] be expected that all [illegible] in the preparation of any [illegible] water supply system [illegible] an extent as to pre- [illegible] changes or departures from [illegible] the work are being put [illegible]

[illegible] made necessary by local [illegible] or ability of the [illegible] against them.

[illegible] of the original plans [illegible] made subsequently thereto. [illegible] of the various sections of the [illegible] examined reveals the follow- [illegible]

[illegible]

[illegible] has been omitted from the plans [illegible] recommendation of the original Board [illegible]

2. [illegible] of Pumping Station No. 3 and the correspond- [illegible] canal between St. Bernard Street and [illegible] changed, for economical reasons.

3. The location of Pumping Station No. 1 has also been changed by the Drainage Commission from the intersection of Broad and [illegible] Streets to the intersection of Broad and Mel- pomene Streets, for economical reasons; and with it the canal lead- ing from this station to the Seventeenth Street Canal.

4. The location of Pumping Station No. 6 has been changed from Bordeaux Street to the line of the N. O. & W. R. R. by the Drainage Commission, so as to be more accessible for the de- livery of supplies.

5. The drain originally located on Carondelet Street near

Third Street has been changed to St. Charles Street by the Drainage Commission to avoid street railroad tracks and large trees.

6. A drain has been placed on Perrier Street near Nashville Avenue by authority of the Drainage Commission, in order to supplement the existing drain on Pitt Street, instead of rebuilding and enlarging the latter.

7. The drain on Jeanette Street near Leonidas Street has been changed to Birch Street to avoid railroad tracks.

8. The drain on Burgundy Street has been changed to Rampart and St. Claude Streets to avoid car tracks and asphalt pavement.

9. The Tulane Avenue drain has been omitted on recommendation of the original Advisory Board as being unnecessary for the present.

We have closely examined into the propriety of making each one of these changes of location and alignment and find them all to have been made in the interest of increased efficiency or economy, without in any way impairing the usefulness of the drainage system as a whole or in any of its parts. We, therefore, consider them to have been wise and proper.

We have inferred that the omission of certain parts of the work, and particularly of the main canal, from the series of contracts already let or to be let in the near future, has been construed by some persons as an intention of altering the original plans. We find no reason for such interpretation. On the contrary, we find that the pumping stations Nos. 1, 2 & 3 have been so arranged and are already partly built, as to receive machinery and other equipments necessary for operation along the line of the proposed main canal, and that the storm water capacity of the relief canals into Lake Pontchartrain, which would be the only alternative means of finally discharging the drainage water of the city, have not been increased in size, nor has any preparation been made in pumping stations Nos. 6 & 7 for such increase in the future.

The work thus far has been carried on in the first, second and third sections in compliance with the relative order which the Engineering Committee recommended should be followed in the second section.

The reason which the Advisory Board gave in their report of 1895 for constructing the work in section two in the order mentioned, thereby affording early relief for the principal and densely built-up parts of the city, we consider to be entirely proper and prudent, and hold equally good for sections one and three. The relief canals are of a sufficient size to carry off all the storm water reaching them at present, and will be so for sometime.

It is our judgment, however, that as soon as the principal and densely built-up sections of the city have been relieved, the work should be continued until the entire system has been completed and all the objects for which this system has been designed shall have been secured. As soon as the city becomes much more densely built up, the amount of storm water running off will become correspondingly greater, in which case the main canal will be required for the purposes of satisfactory drainage. An earlier construction of the same will secure better sanitary results at the present temporary outlets at Lake Pontchartrain.

(B) Changes in Dimensions, Shape and Grades.

The plans of the Advisory Board had to be based on information regarding rain-fall and run-off that was somewhat meagre, in so far as it extended hardly over a single year. Notwithstanding this fact, a general formula, based on experience collected here and elsewhere, had been established by which to compute the probable run-off under special condition found in New Orleans. It was understood that the continuance of the local rain-fall observations and measurements of the run-off from storms of great intensity and extension, would enable the Drainage Commission in advance of contracts to make such adjustments of the sizes of drains and canals as might appear advisable, which adjustments would apply chiefly, and perhaps wholly, to the largest canals of the system.

The experience thus far gained indicates that the drains as built have ample capacity. As yet there exists no necessity for materially altering the original formula, which alteration, if at all required, was applied to all the canals which have already been built, with possibly one exception.

The construction of the St. Louis Street Canal, the first one

built of the series of large lined and covered canals revealed difficulties caused by the nature of the soil and narrowness of the street, which made it advisable to reduce its width. This reduction of the original sectional area, under the existing circumstances, had been approved by the original members of the Engineering Committee of the Advisory Board. It was clear to this committee that for years the reduced width would be ample, and perhaps so for all time. Should, however, the capacity be found insufficient after a considerable growth of population in the section drained by this canal, and the extent of impervious surface have caused a greater run-off than could be carried by it, then it would still be practicable to supplement this canal by one on a parallel street, and possibly even at less cost than the additional cost of building the present canal of larger capacity under the difficulties actually encountered.

The other canals and drains already built had been subjected to a recalculation, based on a more complete series of rain-fall observations, before the contracts for the work were let. We find that the differences arrived at are immaterial and within the natural limits of judgment in such cases. The smaller drains have, as a rule, been built slightly larger, and the larger drains slightly smaller than shown on the plan of 1895.

So far as any alterations in the dimensions of the drains are concerned, we therefore believe the course pursued by the Drainage Commission and its engineers to have been proper and in the interest both of economy and efficiency.

The sectional shape of the drains has been slightly altered from that indicated in the original plans. The side walls are now being made vertical instead of sloping, which alteration reduces the necessary amount of masonry in the walls and also the length of the span of the covering, without reducing the discharging capacity of the drain. The form of support for these walls and of the bottom of the drain has also been changed by providing a continuous timber floor for the whole width of the work. On the score of economy and stability, we fully approve of these modifications.

The original plans indicated a sub-channel, built in the bottom of the canals of 12 feet and over in width, for the purpose of

carrying the ordinary dry weather flow. The only advantage of a sub-channel is the greater concentration of the body of flowing water during dry weather, thereby effecting a slightly greater velocity and offering less opportunity for a deposit or a stranding of suspended material.

During the construction of the St. Louis Street canal it became apparent that the building of the sub-channel, in a soil such as was generally encountered at the bottom of these channels, was an expensive, and, so far as the stability of the structure was concerned, a hazardous proceeding. The question then arose as to weather the advantages were sufficient to justify the cost and risk of building the sub-channel. The Advisory Board of Engineers was reconvened to pass upon this question, and after due consideration recommended that the sub-channel on the St. Louis Street canal be eliminated. The present evidence before us leads us to fully concur in this recommendation.

The sub-channels have thus far been omitted also in the other canals where they were originally suggested. Understanding that in such case the condition of the soil at the depth of this sub-channel was found to be similar to that encountered on the St. Louis Street canal, and believing that a greater assurance of stability of the structure would be of more importance and greater benefit than the above mentioned advantages, the omission of this sub-channel in localities where unfavorable conditions of the soil exist, we consider to be prudent and for the best interest of the work.

The slopes of the drains have been slightly altered in a few cases. As they have been invariably increased, thus increasing also the velocity of flow, it is clear that this alteration can only be beneficial to the system.

No other departures effecting the efficiency of the drainage system have been discovered by us, except the following:

(C) Changes in Pumping Machinery.

According to the original plan, boilers and steam engines directly connected with the pumps were to be placed at each pumping station. Instead of this a central station has been built near

the junction of Florida and Lafayette Avenues, in which it is proposed to concentrate all of the steam plant and from which the power required for operating the pumps is to be distributed by electricity to each pumping station.

This change in the direction of concentration is similar to changes that are everywhere taking place in the industrial and mechanical world.

The advantages of concentration are obvious. With the original plan skilled and relatively high-priced attendants must be kept, night and day, at each of the several stations capable of running and taking care of complex machinery. An additional force of men would also constantly be required for firing the boilers and for other purposes. With the power concentrated at a central station, the total number of skilled men required and the total number of subordinate laborers will be very materially less, and thus a very considerable saving in cost of operation be made.

Major Harrod states that a careful estimate showed that after the completion of the plant there would be a saving of $20,000 per annum from this source and that in the immediate future there would be about five-sevenths of this amount saved annually. This estimate appears to us reasonable. We think also that under conditions of ordinary flow of water the pumping may be so managed that a unit of power from the central station may be used to operate the pumps at the different stations in regular succession, which would reduce a saving in cost of fuel more than that represented by the loss due to the transmission of power from the central power to the local pumping stations.

As an offset to the great saving in cost of operation, there are certain risks which must be considered. For example, one or more of the wires may break down, and thus one or more pumping stations rendered helpless for a short time. This can be reasonably guarded against by duplicating the wires along different routes.

An emergency of greater importance, the possibilities of which should be considered, is the disabling of the central station itself. Considering the method of construction of the central station building, its destruction or that of the plant therein is a very re-

mote contingency. If it should happen and if heavy storms should occur before the plant was restored, flooding of the lowest region lying back of the built-up part of the city would take place. This region will have been rendered much more attractive and habitable in the early future than it is at present by the operation of your drainage works, and the area liable to be flooded will be more or less dotted with dwellings.

Having this in view, we think your engineer should plan and estimate the cost of a reasonable safeguard against such emergency.

An auxiliary electric power station erected at either station No. 6 or 7, capable of furnishing sufficient power to operate the pumps at these stations when acting for relief under the conditions assumed in the original report, would also answer as a relief power station for the entire system to the extent of its capacity.

The total capacity at the central station could be reduced in amount equal to that of this auxiliary station, which would be available for either operating the pumps at Nos. 6 and 7, as contemplated in the report, or in case of emergency could operate these pumps to prevent flooding of the present lowest region or could operate the pumps at stations Nos. 1, 2, 3, 4 or 5, so far as it would be necessary or the power will permit. The cost of such auxiliary plant would exceed that contemplated under present plans by only the cost of necessary additional buildings to house the machinery and would furnish a safeguard in extreme emergencies.

Your second resolution directs us to report upon the character of the drainage work which has been done, and upon the nature and qualities of it, regarding the time in which it has been constructed, the materials which have been used and the probable duration and efficiency of the work for the great purpose for which it has been undertaken.

During the visits, previously alluded to, which we made to many parts of the system and where work was in progress, we examined with great care the brick, sand, cement and other materials used in the construction of the canals and drains. We

found all these materials to be of excellent character for the purpose for which they were being used. It should, perhaps, be stated that the brick, while of ample strength for the masonry to be built and of better quality than those used for similar purposes in many other places, were still not so dense and hard as those used for conduits in some distant cities. We learned from well informed witnesses, including Capt. Hardee, City Engineer, that very hard and dense brick are not made within a reasonable distance of this city.

One departure from the original plan noted during our visit, was the use of what is sometimes called ferro-concrete for the roof or covering of drains. This consisted of monolithic concrete slabs with corrugated steel rods imbedded near the lower surface, and when properly constructed with suitable material is a marked improvement on the original plan. This departure tends to lessen the cost of the covering and also lessen the chance of oxidation of the steel members of said covering. The work was being well done and we approve of this change.

During our inspection we gave the closest scrutiny to the interior surface of the masonry in all of the covered dains which we visited, which included nearly all that have been built. The side walls, floors and roofs were all of good shape and true to line and grade; the joints were full and hard, strong, well set cement mortar and the concrete floors or inverts were very smooth and apparently strong and tough. We found a few slight imperfections in the bottom caused by leaks. Leaks in this character of of work in themselves are not objectionable, but are in fact desirable for subdrainage unless they let in earthy matter, which was not the case here. The work, as a whole, is of an excellent character, and we believe it will last for many generations.

We would say in this connection that all the engineers and others that testified before us were asked particularly if they knew of any defects of construction in your drainage works; while most of them testified to its general excellence, none of them pointed out or knew of any defects.

In examining and comparing specifications, we noted the use of a cement not mentioned in the original specifications, viz: Steel

Portland cement. This is in reality a Puzzolan-Slag cement. The cements mentioned in the original specifications were imported Portland and Natural cement. Each of these three cements is composed in different proportions of lime, silica, alumina and other elements.

In Portland cement the various ingredients are intimately mixed in fine particles, are burned to a clinker, and the latter is finely ground.

Puzzolan-Slag cement is made by intimately grinding and mixing together suitable blast furnace slag with slaked lime, no burning being required after mixing.

The Slag cement used on your work bore the commercial name already mentioned of "Steel Portland." We have tested this cement to some extent in other parts of the country and found it stronger than some brands of Portland, but not quite so strong as some of the highest grades of Portland. Our own tests were not sufficiently extensive to enable us to positively assign its true rank.

Puzzolan-Slag cement is used in various parts of the world by engineers of the highest standing. For instance, much has been used within two or three years in the tunnel in Paris for the prolongation of the Orleans Railroad.

The testimony of Prof. Creighton and others is very positive that the so-called Steel Portland furnished here was better than most of the imported Portland cements which were offered and passed under the original specifications.

According to the testimony of Prof. Creighton, of Mr. A. C. Bell and of Mr. W. J. Hardee, these engineers are unanimous in the opinion based on their own experience that the Steel Cement is of especial value and therefore desirable where used in connection with work that is constantly subjected to dampness.

The original specifications for this work called for the best imported Portland, and gave certain physical tests, which under ordinary usage would serve to fix the quality required. These tests, although substantially the same as those used by many eminent engineers, including officers of the U. S. Corps of Engineers, were in the light of our present knowledge imperfect and

unsatisfactory. They permitted very coarsely ground cements to be used, while it is believed that only the very fine particles have a cementitious value: the tensile tests were applied only to neat cement, although tests which include sand are much more valuable.

In the light of present knowledge, these specifications were defective also in other particulars. The new cement specifications, drawn up by Major Harrod in consultation with Prof. Creighton, avoided all the defects alluded to above and were of a scientific character. There is no doubt that they very materially raised the standard of the cement above that of the original specifications for imported Portland cement, and that they thereby secured a higher grade of cement, even though it was not imported, than that which could have been supplied under the original specifications.

We deem this change in the original specifications for cement therefore to have been very desirable and one beneficial to the character of the work as it elevated the general requirements of cement.

We compared on your work very carefully the concrete and mortar in which slag cement was used with that in which true Portland was employed and was unable to determine which was the better. Both appeared to be hard, good and satisfactory.

Natural cement is made by burning and then grinding a rock containing the necessary constituents. American Natural cement has much less strength than either Portland or Slag cement. It is nevertheless used in enormous quantities in all parts of the country and on many underground conduits and tunnels.

In examining the joints in the brick walls of your canals and drains, we found the Natural cement mortar less hard than that made with either the Portland or Slag cement. The former could be to some extent removed with a sharp, steel blade, the latter could not; nevertheless, the Natural cement appeared to have fully answered its purpose. We discovered no joints that had been washed out or had deteriorated.

It appears by comparison with the original specifications and the engineer's estimates of completed work, that the proportion of

Natural cement originally contemplated has been materially reduced and that slag or Portland cement of superior strength has been substituted therefor. This departure from the original plans is of course also an improvement.

It should be noted here that the use of true Portland cement (of American manufacture) superior in quality both to the imported Portland used on your first contract as well as to the Puzzolan-Slag cement, has been required on the most recent work. We deem this a further improvement.

Your resolution contains a reference to the time in which the drainage work has been completed. The time spent in constructing the drains and canals does not appear to us to have been excessive. The only serious delay in any part of the work, so far as we know, has been caused by the delay in having the proper machinery installed at stations Nos. 1 and 2, thus postponing the full benefit which might otherwise have been had from the completed drains in the first and second sections.

Such delays and disappointments are not at all unusual in this class of work, especially during the past five years, when it has been a rare exception to have machinery delivered anywhere in this country on contract time. The original contract time for the completion of this machinery was too limited to secure the high grade work contemplated by the specifications. Added to this delay came that caused by a misunderstanding on the part of all the principals as regards the contract requirements, which was eventually satisfactorily settled by the Board of Arbitration. Since the finding of this Board, satisfactory progress has been made and is being made. Part of the installation at No. 2 station is now completed and it is expected that the whole installation will be finished soon and in advance of the agreed time.

The annoyance that has been caused by this delay will, we think, be recompensed by the resulting improvements in the machinery at all the stations yet to be installed, which the study and experience at station No. 2 has suggested.

Before concluding, we ought to mention that during our inspections we found several places where iron pipes crossed the drains and canals. These are obstructions that ought to be re-

moved. We should also state that a number of street drain pipes project into the canals so as to form obstructions, and that the street connections are also in some other cases of a faulty character. The faults can be easily and should be corrected.

We also wish to mention that quite a number of the drains and canals contain a large amount of deposits of mixed character. As soon as the pumps at either stations, Nos. 1 or 2, are installed, the deposit which has been collected in the drains and canals leading to these stations should be removed, so that thereafter these drains may be kept free of deposit so far as it is possible by the operation of the pumps.

So long, however, as the ordinary flow in the drains and canals will necessarily contain much sewage matter, which will continue until the proposed sewerage system shall have been built to receive it, it is advisable, in our ouinion, to pay constant attention to the cleaning and flushing of these drains and canals. Our reason for this recommendation rests on the fact that the latter structures are not designed as sewers and that the sand and silt naturally entering them from the street surface, and in some cases temporarily depositing in them, will be apt to retain also some of this sewage matter which may cause on odor at the surface inlets to the drains.

We also desire to state that for the purpose of drainage the full benefit for local relief cannot be expected until more frequent connection with the gutters than exist at present shall have been made.

It is apparent that the cost of constructing the drainage work has not differed materially from that estimated by the Advisory Board in 1895. About one-half of the entire work has been built for less than one-half of the estimated cost. Unless the price of labor and material increases, it may therefore be expected that the expense of completing the work will closely approximate the original figures.

The inability to have so far secured but one-half of the entire estimated amount of money naturally leaves nearly one-half of the work untouched.

We find that up to the present the funds have been properly

applied so as to secure to the districts of greater density of population the first consideration and benefit, and that outfalls have been provided for their drainage water into Lakes Pontchartrain and Borgne. While these outfalls are all a part of the permanent system, those discharging into Lake Pontchartrain are intended eventually to exclude the ordinary flow of seepage and offensive water and to serve only for the surplus water delivered during large storms.

This exclusion, however, cannot be effected until after the funds shall have become available for constructing the remaining part of the main canal.

In conclusion, we state that the original plan has been substantially carried out, that whatever departures were made have been beneficial to the work, that the material and construction have been suitable and good, and that the order in which the work has been undertaken is a proper one. We are of the opinion that the work reflects credit upon the city and upon those engaged in constructing it.

Respectfully presented,

(Signed) RUDOLPH HERING,
G. H. BENZENBERG,
HOWARD A. CARSON,
Board of Engineers.

APPENDIX "I."

MATTER PRESENTED TO THE BOARD OF ENGINEERS BY THE DRAINAGE COMMISSION.

1. Copies of communications charging departures from plans and from originally specified character of work.
2. Copy of original report covering original *general* plans and specifications of the Advisory Board.
3. Ordinance of City Council adopting plans.
4. Legislative act creating Drainage Board.
5. Special plans and specifications subsequently made.

NOTE: The documents under items Nos. 2, 3, 4 and 5 are not attached hereto, as they are public documents in print and easily accessible.

NEW ORLEANS, AUGUST 10th, 1901.

MR. M. J. SANDERS, President,
New Orleans Progressive Union, Ltd.,
No. 807 Common Street, City.

Dear Sir:

I am directed by the Drainage Commission of New Orleans to acknowledge the receipt of a communication from you of August 6th, enclosing a resolution adopted by the New Orleans Progressive Union at its regular monthly meeting of August 5th, 1901.

The Drainage Commission recognizes the keen interest manifested in the drainage system by that public spirited body, and the fairness and value of the suggestion in your letter that "definite information, both as to what has been done and what is still further proposed to be done" should be given the public.

The Drainage Commission has, therefore, directed the preparation of a statement covering its past and proposed work by the Executive Committee and Chief Engineer. The committee will communicate with you later.

Any statement made by the Drainage Commission will necessarily be confined to the subject of drainage; the works for water supply and sewerage, to which your inquiries extend, are in-

trusted, by legislative enactment, to a distinct board, of which his honor, Mayor Capdevielle, is President.

Yours very truly,
(Signed) IRWIN JAMISON,
Secretary Drge. Board.

NEW ORLEANS, August 2nd, 1901.

HON. R. M. WALMSLEY, President,
The Drainage Commission of New Orleans, City.

Dear Sir:

I have, owing to the embarrassing position in which I am placed realtive to the drainage matter, hesitated in making any public expression of my views, but am constrained, for the welfare of this city, as also for the protection of my professional position, to address you advising that the execution of the drainage work, as proposed by the recent adjudication, will most seriously affect the future welfare of this city, for the reason that the work proposed will not, when completed, provide a benefit commensurate with the expenditure, and is in direct violation of the plan of drainage as adopted by the City Council and approved by the Legislature, and will positively defeat the benefits which the adopted plan contemplated. And as the work now in hand will absorb all money available for drainage work for years to come, it should be determined upon only after a very careful consideration of the subject and embrace such work as will secure to all sections of the city some reasonable benefits, and, further, should in some measure give the city the benefits which the original plan contemplated.

I have spent several years of my professional career in the investigation of the drainage question of this city, and in later years, made the necessary examination and prepared plans and specifications for the work, which were approved and adopted, and I feel that I would be derelict in my duty to my professional and personal interests, as also to the citizens of the city of my adoption, were I to fail to express my views to you prior to your signing the contracts for the work recently adjudicated.

Yours respectfully,
(Signed) L. W. BROWN.

NEW ORLEANS, LA., August 6th, 1901.

MR. R. M. WALMSLEY,
President, Sewerage and Drainage
Board of New Orleans, City.

Dear Sir:

At the regular monthly meeting of the New Orleans Progressive Union last evening, the question of sewerage and drainage was discussed and an address was given by Mr. Charles Louque, and a paper by Mr. L. W. Brown was read. Mr. Louque, apparently without any animus, severely criticised and condemned considerable of the work that has been done and the plans that are proposed to be carried out, at the same time pointing out that the defects he alluded to could be remedied without necessarily interfering with the general plans adopted. The members present, whilst feeling that probably the criticisms might be well founded, feel that it would be only right that the Drainage Board and their Chief Engineer, Major Harrod, should they desire it, have an opportunity of replying to the criticisms. The Progressive Union invited the discussion on this matter yesterday evening, because they find that there is a wide-spread anxiety for clearer and more definite information, both as to what had been done and what is still further proposed to be done in this important matter of drainage. The public, we find, is also very anxious to know when some progress is to be made in regard to the sewerage of the city, and the following resolution was adopted:

"That the President of the Drainage Board be requested to have the members or the engineers of the drainage system designate some evening when they would be prepared to demonstrate and discuss the plans they intended to follow in their work on the water, sewerage and drainage of the city. Also, that Major Harrod be included in the invitation and have him explain everything as clearly as he did before the plans were submitted to the people of this city for ratification."

Whilst the New Orleans Progressive Union is not desirous of being considered in any way as a busybody, it is peculiarly an object of the Union to manifest a keen interest in this matter which is undoubtedy one of the most important to the welfare of the

whole community, and I am quite certain that if your Honorable Board desires to make any statement regarding the matters committed to its charge, a very large and fully representative meeting of the citizens can readily be obtained. Whilst the membership of the Union is larger than that of any other public body of the city, it would, of course, invite all citizens alike to attend any meeting where the Drainage Board desired to enlighten the community.

Yours very truly,

(Signed) M. J. SANDERS,
President.

(February 6th, 1902.)

REPORTS FROM THE SPECIAL COMMITTEE

AND THE

CHIEF ENGINEER OF THE DRAINAGE COMMISSION.

REPORT OF THE COMMITTEE—LOUIS CUCULLU, JAMES MCCRACKEN, C. T. YENNI.

"We, the undersigned committee, appointed for the purpose of investigating the rumors that cheaper grades of cement than called for in the specifications have been substituted in past and present contracts, without a corresponding rebate to the Commission, thereby largely increasing the profits of the contractors, without any benefit whatever to the Commission, we respectfully report, after due investigation, as follows:

"In contracts "A" and "C," which were awarded to the National Contracting Company on Aug. 9, 1897, and merged into one contract, and in contract "F," awarded to C. F. Collom & Co., July 28, 1899, the specifications called for the use of American cement on certain portions of the work and imported Portland cement on other portions.

"After the acceptance of the bids of the National Contracting Company and Messrs. C. F. Collom & Co., we find that Major Harrod, our chief engineer, drew up supplemental specifications, affecting the cement to be used, providing for tests, etc., authority for which, the engineer claims, was vested in him by the original specifications.

"The estimated aggregate number of barrels of imported Portland cement which the specifications called for, and which were permitted to be substituted by American cement under the supplemental specifications, was forty-nine thousand two hundred and twenty-one barrels (49,221).

"The difference in the price of cement used, which is admitted by the engineer to have been cheaper than that called for in the specifications, has not been ascertained by your committee, owing to the very short time that this matter has been under investigation. But, whatever the difference may have been, the Drainage Commission has not been a beneficiary in any amount.

"The substitution was not made with the approval of the Commission, as the engineer failed to officially notify the Commission of the substitution by the amended specifications, and therefore not obtaining the Commission's ratification of the change, the engineer made a very serious error.

"The specifications for contracts awarded in July, 1901, to the National Contracting Company, United States Construction Company and Messrs. Nash & Dowdle and John McCoy, which also called for the use of imported Portland cement on certain portions of the work, have also been modified after correspondence with the various contractors to permit the use of certain standard brands of American Portland cement, in lieu of the imported article, but same is being done with the approval of the Commission, which is being benefited in the reduced cost of construction to an amount of not less than ten thousand dollars ($10,000).

"We respectfully close our report with the suggestion that our chief engineer be requested to make a full and lucid statement of the circumstances under which the substitutions were permitted by him."

REPORT BY MAJOR B. M. HARROD.
(The Chief Engineer of the Board.)

"In obedience to the request, contained in the report of your committee, I beg leave to submit the following statement:

"The general specifications adopted by the City Council in 1896 were vague concerning the quality of cement to be used, the properties required and the tests to be exacted. In the case of imported Portland cement, it was only required that 95 per cent. should pass through a 2500 mesh sieve, and that a seven-day neat test should give a tensile strength of 400 pounds per square inch.

"The special specifications for the contracts of 1897 with the National Contracting Company, and of 1899 with C. F. Cullom & Co., added nothing to these requirements beyond calling for bids on the following items:

"Contract 'A'—National Contracting Company—Central power and pumping stations and lined and covered canals.

"Brickwork—American Natural Cement—1 of cement, 2 of sand.

"Imported Portland Cement—1 of cement, 2 of sand.

"Imported Portland Cement—1 of cement, 3 of sand.

"Concrete—American Natural Cement—1 of cement, 2 of sand.

"Imported Portland Cement—1 of cement, 2 of sand.

"Imported Portland Cement—1 of cement, 3 of sand.

"Contract 'F'—C. F. Collom & Co.—Lined and covered canals.

"Brickwork—American Natural Cement—1 of cement, 2 of sand.

"Portland Cement—1 of cement, 3 of sand.

"Concrete—American Natural—1 of cement, 2 of sand.

"Imported Portland Cement—1 of cement, 3 of sand.

"Surfacing—Portland Cement—1 of cement, 1 of sand.

"These contracts afford the only instances where steel Portland has been used in the place of imported Portland cement, and in such case it is left undetermined in the specifications, and presumably at the discretion of the engineer, in what part of the work the different material bid for should be used.

"Subsequent to the adjudication of these contracts, application was made by the contractors to be allowed to use steel Portland cement. and American product where the bid had been for imported Portland. Additional conditions, both physical and chemical, were then attached to the specifications, and the contractors were informed that if that cement complied with the higher or more detailed tests its use would be allowed. The additions to the specifications required much finer grinding, certain tensile strength at different periods, and when mixed in different proportions chemical analysis and other examinations. The material used under this agreement was under constant test at Tulane University, and its acceptance or rejection was determined by these tests. It proved satisfactory under the tests, as was also the work in which it was used.

"The advantages which may have accrued to these contracts from the use of a cheaper cement than was specified may be estimated in the following manner. The measurements for final estimates for payment on the part of these two contracts where steel Portland instead of imported Portland cement was used were as follows:

	Brickwork. Cubic Yds.	Concrete. Cubic Yds.
National Contracting Company	46,099	33,109
C. F. Collom & Co	———	4,842
	46,099	37,951

"Under the contracts let in 1901, propositions were received from the contractors to use steel Portland instead of the other grades of American Portland cement, at a reduction of 18 cents per cubic yard of brickwork, and also to use these other brands of American Portland instead of imported Portland cement, at a reduced price of 8 cents per cubic yard. The steel Portland could, therefore, be used in brickwork for 26 cents less per cubic yard than the imported Portland cement. The difference in concrete would be about twice this amount, or 52 cents per cubic yard. Applying these prices to the quantities given above gives a difference in favor of the contractor of $31,720.26.

"This is the difference as it existed last year, based on propositions of the contractors. I have no information whether it would have been more or less in 1897.

"The price at which steel Portalnd could be obtained allowed the contractors a larger profit than there was in the use of imported Portland, but the tests under which it was used were more complete and exacting than those which were provided in the general and special specifications under which the bids were made, and the material proved satisfactory under these tests and in the work.

"I recognize the justice of the censure conveyed in the report of your committee in regarding this transaction as an error, inasmuch as better terms might have been exacted from the contractor, and as it should have been referred to the committee for its sanction.

"In subsequent contracts, those of July, 1901, with the United States Construction Company, for pumping station No. 3; with the National Contracting Company for the Third Street and St. Bernard lined and covered canals; with Nash & Dowdle for the Nashville and Lowerline lined and covered canals, and with John McCoy for the Algiers lined and covered canals, the specifications called for bids for brickwork on American natural and on Portland cement; for concrete on American natural and on imported Portland cements, and for surfacing on Portland cement.

"In order to secure uniformity in the bids and make them readily comparable, one with another, contractors were advised to base their bids on imported Portland, complying with a special specification of qualities and tests. Propositions were received subsequent to adjudication for the use of American Portland cements, at a fixed rebate in favor of the Drainage Commission, provided that they fully complied with the spceifications for imported Portland. The arrangements based on these propositions are now in effect, and estimates and payments are made at the reduced rates. Tests are regularly made at Tulane University, which determine their acceptance or rejection. The brands which contractors have chosen to offer are the 'Atlas,' 'Universal,' and 'Vulcanite.' They have been faithfully sampled and tested with satisfactory results

"The papers and correspondence on which this statement is based are part of the records of this office."

ADDRESS DELIVERED AT A MEETING OF THE PROGRESSIVE UNION BY MR. CHARLES LOUQUE.

"The proposed drainage system, if properly carried out, will be a desirable improvement, and the health and prosperity of the city will thereby be greatly improved. But if the work is improperly done, if the canals are permitted to become clogged with filth, then an unhappy sanitary condition would follow. The great danger is that a proper circulation of the water in the canals will not be maintained.

"One great objection is that the canals are too small. Take as an illustration the canal in Camp street. When it reaches Canal street it is five feet deep. But at Canal street it is intersected by a water pipe forty-eight inches in diameter, which crosses it diagonally, and so obstructs the canal that during and after a heavy rain it cannot carry the water, and the result is an overflowing of the streets. The same condition prevails at Camp and Julia streets. The only remedy for this is to remove the water pipes.

"Then again the pumps are inadequate. As far back as February, 1899, I wrote to Mayor Capdevielle, Louis Cucullu and Charles F. Claiborne, who were at that time on the Drainage Commission, and pointed out to them that the pumps contracted for would not do the work they were designed to do. I will read the letter sent to Mr. Capdevielle:

" 'I come to caution you, first as a friend, then as a party interested, thirdly as an expert, and solely for your particular and personal use, that the pumps which the contractors of drainage are at this moment putting up at Broad street will prove a total failure.

" 'The gigantic proportions of the preliminary work would lead one to suppose that the pumps were to be the largest in the world, while the pumps themselves are simply playthings and toys.

" 'The suction pipes have a diameter of 8 feet, which is equivalent to an area of 50 square feet. These pipes will throw the water to a pump that will only let out through an aperture of 2 feet square.

" 'These are the pumps which these gentlemen propose putting up. Examine the contracts on the subject of drainage machines, and make no more payments until the contractors have demonstrated that the capacity of the pumps is equal to the amount contracted for. I write the same to Louis Cucullu and Charles F. Claiborne.

'Yours truly,

(Signed) CHARLES LOUQUE.'

"To-day I received a letter from Chas. F. Claiborne, in which he says he submitted my letter of Feb. 24, 1899, to Major Harrod, who has charge of the drainage work, and Major Harrod replied that he could not tell whether the complaint was well founded or not, and that the contractors were responsible for that.

"Major Harrod, the expert in charge of the work, confessed that he did not know whether the complaint was well founded or not. He confessed that he didn't know that fifty square feet of water could not get through an aperture two feet square. Here is a man who has charge of the expenditure of millions of dollars, who by this admission alone, proves his incompetency for the work he is paid a big salary to supervise.

"After a heavy rain it was found that there were four feet more water on the suction side of the pump than on the discharge side, and all that would have been necessary to have been done was to have opened the gates and the water would have run off. After this the pumps were rejected, but not until thousands of dollars had been paid for them.

"Nor is this all. The Drainage Commission is not carrying out the plans that were first proposed, and which were submitted to the people of New Orleans and ratified by their votes. Those plans contemplated the construction of the Broad street canal, which was to have been seventy-five feet wide. But the Broad street canal has been abandoned, and it was to have been the main

artery through which the water was to be carried to the lake. What is the use of having the pumps if there is no canal to carry the water.

"Another great defect in the drainage plans is the system of allowing all the water to run to the lowest part of the city and then raising it again by means of pumps. Would it not be the better plan to provide for running this water from the higher parts of the city directly to the lake than to raise it after it has once run down hill.

"The two pumps now in operation cost the city $4300 a month to raise the water back to the level from which it has been alowed to run. That is about $50,000 a year that is being uselessly expended.

"But the Drainage Commission will tell you that the pumps work well, except when they get hot and cannot be used. But of what use are the pumps since the Broad street canal has been abandoned?

"The canals that have been constructed are rapidly being filled by the banks caving in. The Melpomene canal, which should be fifty feet wide, is to-day no more than thirty feet wide for this very reason.

"The Drainage Commission has erred in another particular, and that is in using electricity to run the pumps. It empoys a steam engine to generate electricity to run a dynamo to run the pumps when the dynamo is set for sixty-seven revolutions per minute no power on earth can make it go faster. Why not use the engine direct to supply the motive power for the pumps?

"Even after the drainage system is completed a large part of the city will not be drained. It is said by those in charge that the uninhabited portions of the city will not be drained until after they are inhabited. But they can't be inhabited until they are drained, so it looks as if there is no future for those parts of the city."

PAPER BY MR. L. W. BROWN.

"Ordinance No. 7170, approved Feb. 6, 1893, was the measure under which the present system of drainage was inaugurated.

"The work under contract, and which has been in the course of execution since 1897 (four years), represents an expenditure approximating $3,000,000, and in the past few days contracts have been awarded which will consume all the funds now available for drainage purposes in this city for the next generation.

"It will be well to observe that there is, perhaps, about one-fifth of the work, as provided for by the original plans and specifications, which is now executed or in the course of execution, which was started in 1897, and which has cost, or will cost when completed, approximately $3,000,000. At such a rate it would take twenty years to complete the drainage system in its entirety, and would cost upward of $15,000,000, or nearly three times the estimated cost of the adopted plan.

"One of the most prominent features in connection with the work of the drainage which has been done is that the original plan has not been adhered to, and its two salient features have been entirely ignored, which were the discharge of polluted drainage water into Lake Borgne, and the removal of all surface water from the whole area of the city bounded by Lake Pontchartrain, the Mississippi River, People's Avenue, Florida Walk and Fisherman's Canal. These two features of the general plan should, for the future welfare of the city, never have been ignored, as with an increasing population we must have an unpolluted lake shore, and for the sanitary condition of our city we must reduce the moisture line, reclaiming our swamp lands within the area of the city, and thus reduce the malaria breeding area, and materially assist Prof. Beyer in his herculean undertaking to exterminate the mosquito.

"A short insight into the future, to me, clearly discloses the fact that all available funds for drainage will be expended and the drainage of the city will be no better than it was in 1896, although we will have expended a world of exertion, thought and care in the preparing of the drainage plans; will have spent a large amount of labor in the execution of the work, and will have disbursed about $4,000,000; yet the results will be far from those anticipated when the work was inaugurated in 1896, being a little or any better than the then existing system; and perhaps the saddest disappointment of all the previous disappointments to

which New Orleans has been subjected, will be the one she will experience within the next year when no further money is available for drainage work and her drainage absolutely inefficient.

"With reference to the sewerage work for the City of New Orleans, there has never been any attempt, to my knowledge, made towards the construction of sanitary sewers in this city until 1892, when a contract was adjudicated for the construction of a sewerage system to embrace, within a period of five years, or by 1897, the territory between Louisiana Avenue, Enghien Street, the Mississippi River and Claiborne Street, and to be gradually extended to other portions of the city. This work was let to private parties who, after spending some considerable money and executing some extensive work, abandoned it. In 1899 the taxpayers voted a special tax of two mills, beginning with the year 1899, which was made effective and became a law by Act No. 6 of an extra session of the Legislature of 1899. The board, as created under this act, is composed of sixteen members, and while the board, as organized, has made surveys and prepared plans and specifications, no definite action has been taken relative to the inauguration of work. The work so far done by the Sewerage and Water Board in the inauguration of work is in keeping with the old adage that 'all large bodies move slowly,' although a reasonable excuse may perhaps be found to exist in the vexing query as to what shall be done with the old Waterworks Company and their monopolistic franchise.

"The very extensive area of the territory covered by the inhabited portion of New Orleans, in proportion to the population and wealth of the city, as compared with other large cities, almost precludes the possibility of securing any absolute and positively satisfactory sanitary improvement, if we attempt to make these improvements extend to all that portion which is inhabited; hence as a business proposition and as a measure which is of great benefit to the greater number of the inhabitants of our city, would it not be proper to confine the work to an extent of territory coextensive with the funds in hand to produce absolutely and positively satisfactory conditions beginning with the most intensely populated territory, and on the principle that 'a little leaven leaveneth the whole loaf' would we not with more rapidity and more cer-

and still is a matter of great professional moment to me, and I am interested in securing to this city the greatest possible benefits therefrom.

"As a matter of fact, I am professionally identified with the work throughout the engineering world, having spent much time and labor between the years 1886 and 1896 in making investigations and working out and designing the plan of 1896, and have since recorded in the engineering world a very considerable amount of literature on the subject. The long study I have given the matter has necessarily made me familiar with every detail, and I have viewed with considerable anxiety the methods which have been adopted in the execution of the work, especially when they effected, as has been the case, the integrity of the structures and the efficiency of the system as contemplated by the plans of 1896. I have on several occasions pointed out that the work as now being executed was in direct violation of the plans of drainage as adopted by the City Council in 1896, and later approved by the State Legislature, and that, in my opinion, the eminent success of the results as contemplated would be very materially modified.

"As is generally known, when I had completed the plans in 1896 I was retired from active charge of the work, and was engaged for two years by the National Contracting Company, but since 1899 I have had no direct connection with the work.

"In all the work I have done for the drainage of this city, even when employed by the National Contracting Company, I have endeavored to secure the best possible results to the city from the work, and have on many occasions, even while acting as the contractor's engineer, taken occasion to widely differ with the Chief Engineer of the Drainage Board relative to the methods which were adopted, and in many instances my differences were recorded in a communication; but to not one of my many protests has any attention been given, and I am constrained to now record that the drainage system of 1896 is practically annihilated, both as to stability and efficiency; and to further record that if the Chief Engineer be called upon to describe the engineering features, advantages and value of the system as it now exists, he would be unable to do so, as the many changes have destroyed all the value of the fundamental formula of the system of 1896.

"As to the original specifications for the work, which were prepared with extraordinary care, and which have received the commendation of some of the ablest engineers of the country, under the interpretation of a careful and competent engineer, it would be impossible to secure other than satisfactory results, and the contractor could secure no advantage were they strictly adhered to.

"As to the use of Utica and other natural cement, I have repeatedly expressed myself to the Chief Engineer of the Drainage Commission and to others to the effect that, in my opinion, it is most ridiculously absurd and a violation of proper engineering usages to use natural cement in the retaining walls of work, such as forms the large conduits of the drainage system, when the work should be expected to last two hundred years or longer, and in my opinion the question of money saved by the use of a natural cement over that of a high grade artificial cement for work of this class is but a small matter as compared with the value of the stability of these expensive and constantly needed structures, and, as I have often remarked, the difference in cost of a high grade artificial cement would not exceed $100,000 for the whole of the work over the cost of natural cement, and the advantages would be inestimable. Several thousands of dollars have been expended by the Drainage Board for the testing of cement, and it would appear that this sum should have included some good advice as to the quality of cement proper to be used in this important work. And, again, several thousands of dollars have been recently expended for expert engineering advice in connection with the drainage work, and it is to be regretted that an opinion should not have been expressed as to the stability and longevity of the structures they examined; and it is further to be regretted that any conditions should have arisen requiring this expensive expert examination.

"The explanation of the National Contracting Company as to the cement they used must necessarily be extended further than is implied by the statement published yesterday, as I personally took no part whatever in any transaction relative to cement, either in negotiations with the Drainage Commission as to quality or for the purchase of same.

Respectfully,
(Signed) L. W. Brown."

APPENDIX "II."

CORRESPONDENCE OF BOARD OF ENGINEERS WITH MR. L. W. BROWN.

NEW ORLEANS, March 14, 1902.

MR. L. W. BROWN,
No. 741 Carondelet Street, City.

Dear Sir:

Having received a copy of a letter, signed by yourself, wherein you made certain charges of departure from the plans and specifications of the work as carried out by the Drainage Commission, we would request you to kindly appear before the board at 9 o'clock to-morrow (Saturday) morning, or at your earliest convenience thereafter, with such data and information you may have specifying the character of such departure in detail, in order that we may with proper information act under the resolution authorizing the appointment of this board.

Very truly yours,
(Signed) RUDOLPH HERING,
Chairman, Board of Engineers of Inquiry.

NEW ORLEANS, March 15, 1902.

MR. RUDOLPH HERING,
City Hall, City.

Dear Sir:

Replying to your favor of March 14th, requesting me to appear before a Board of Engineers of inquiry for the purpose of detailing to the said board the character, etc., of the departures which have been made from the original plans of the drainage work of

this City, I would respectfully suggest that the best interests of this city would be subserved were your board to proceed and make your examination and report without any guidance or suggestions in the matter from Local Engineers. As a matter of actual fact, your engagement is for the purpose of ascertaining to what extent, if any, the work now completed fails to comply with the work and results as contemplated by the drainage plans of 1896, and as all the conditions and facts in connection with the matter are actually constructed, and hence actually before you, any suggestions or explanations at this time from local engineers would, in my opinion, be not only inopportune, but actually prejudicial, to the interests involved.

Your connection ith the work began in 1893, and continued to the completion of the original plans in 1896, and you have since been associated with the work; hence, you cannot fail being familiar with it and consequently you are in position to detect the failures and defects. You are also in a position to know and appreciate the intensity of my own personal efforts in the matter of securing to this city a proper and effective System of Drainage; and you can also appreciate the discouragement which it was my misfortune to encounter in connection with the work; and the letter to which you refer is only one of several which I have written, being actuated in the matter only by a desire to see this city secure some benefits from the large sums which have been expended, and I will admit that I have a personal ambition, as an engineer and a taxpayer, to see the benefits we all anticipated in 1896 realized.

As to any personal feeling for any one connected with the work, as the press has charged, there is absolutely none, neither is there any foundation whatever on which such a charge may be based, as personally I have the kindest feeling towards, not only those connected with the drainage work, but for every member of the profession.

The importance of this Drainage work, as permanently effecting the present and future welfare of this City, is too great, in my opinion, to admit of any experiments or to be trifled with in any way, and I feel confident that the very near future will demon-

strate the necessity for very considerable expenditures in re-modeling the work before the satisfactory results contemplated in 1896 will be realized.

I would embrace this opportunity to observe that while less than 2 inches of rainfall occurred yesterday, the City was inundated to as great, if not greater, extent than with the same rainfall was the condition prior to the inauguration of work in 1897; and you no doubt embraced the opportunity to witness the absolute and positive evidence of the disastrous results to this City accruing from the modifications of the original plans of 1896, as refer to the reduction of dimensions and grade, carrying capacity, of the canals, which modification was concurred in by you and against which modifications, you will remember, I vigorously protested in a letter addressed to you and to the Chief Engineer of the Drainage Commission in May, 1898. As a matter of fact, this modification, including the abolishing of the sub-channel for daily flow, embraces one of the most serious defects of the system, and no Engineering logic or reason can controvert the actual results as now secured and as now evidenced under actual conditions.

I could enumerate other defects which cannot be overlooked by strict Engineering inquiry, but reiterating my former statement, I do not consider it proper that your investigation should be trammelled by the views of Local Engineers.

Very respectfully,

(Signed) L. W. BROWN.

NEW ORLEANS, MARCH 15th, 1902.

MR. L. W. BROWN, C. E., 741 Carondelet St., City:

Dear Sir—Your letter of this date is received, and the Board of Engineers regret that you did not call in response to my letter of yesterday.

We are aware that our "engagement is for the purpose of ascertaining to what extent, if any, the work now completed fails to comply" with the drainage plans of 1896; and as you say you

have written several letters on the subject and could "enumerate other defects" than those mentioned in your letter of to-day, and because of your interest, personal efforts and knowledge and information upon the subject, as evidenced by your own statements in said letter, we are of the firm opinion that you could greatly expedite our work by coming before us and specifying all the facts and detailing all the departures which in your opinion necessitate "re-modeling the work before satisfactory results contemplated in 1896 will be realized," and of modifications that will cause "disastrous results to this City;" and we hope that you will, for these very sufficient reasons, call to facilitate the work in which we are here engaged, and that you will on receipt hereof inform us when it will meet your earliest convenience to call.

Yours truly,

(Signed) RUDOLPH HERING,
Chairman Board of Engineers.

NEW ORLEANS, March 18th, 1902.

MR. RUDOLPH HERING, Chairman & Members,
Board of Engineers of Inquiry, City.

Gentlemen:

Your favor of March 15th only reached me late last night, and I now hasten to answer.

Through my direct connection with the drainage work of this City and the great amount of time and labor which I have devoted to it, I certainly am most thoroughly informed as to what is necessary to secure the results we anticipated in 1896, and I would add that this information, which is the result of much time and labor, was acquired, I am proud to say, without any cost whatever to the taxpayers of this city.

I have, as the records will show, directly addressed the Drainage Commission on several occasions with reference to the work as now being executed, and on February 7th last, I addressed them a communication placing my services at their disposal, thinking that they would desire to have the opinion of some one who

was thoroughly informed as to the work, and I would have been pleased to have served them without remuneration. Unfortunately this letter was construed by the press as an application on my part for the position of Chief Engineer, which was far from my intention; and to avoid any further misconstruction of my actions, I have decided to henceforth consider the time and energy I have expended on the drainage work of this city as permanently lost to me or to those depending upon me, and I shall for the present devote no further attention to the matter.

Very respectfully,

(Signed) L. W. Brown.

APPENDIX "III."

PUBLIC HEARINGS OF THE BOARD OF ENGINEERS INQUIRING INTO THE DRAINAGE SYSTEM OF NEW ORLEANS.

BOARD OF ENGINEERS:

RUDOLPH HERING,
GEO. H. BENZENBERG,
HOWARD A. CARSON.

NEW ORLEANS, March 14, 1902. 1 P. M.

Mr. R. M. Walmsley, Preident of the Drainage Commission, addressed the Board of Inquiry as follows:

Some questions having arisen concerning the Drainage System that was adopted some years ago, and being essentially a public matter, the Drainage Commission thought it was only due the public that a Board of Inquiry should be called and the whole matter gone over and exhaustively examined, and with a view of having that done, the Drainage Commission have selected you as a Board of Inquiry for that purpose.

You can understand that the work is a very important one and some of the questions that have arisen are also very important, and having the greatest confidence in your ability, integrity and your knowledge of matters of this character, we confidently confide this investigation to you. With a view of suggesting some of the questions which will be considered, we hand you

1st. Resolution appointing you as a Board of Engineers. For that purpose you will find that it contains the suggestion that you are authorized to call for persons and papers, and we would like extremely well to have every side of this question canvassed so that those who have brought forward the objections can be called before you for investigation.

2nd. Resolution appointing a Committee of Engineers.

3rd. Request for investigation made by Chief Engineer B. M. Harrod.

4th. Copy of communications charging departures from plans or from original specified character of work.

5th. Copy of original report covering general plans and specifications of the Drainage Board.

6th. Ordinance of the City Council of New Orleans adopting the plans, etc.

7th. Legislative Act creating the Drainage Commission of New Orleans.

8th. Special plans and specifications made subsequent to original plans.

The Chairman—Is there anyone here who has any charges to make of departures from plans or from original specified character of work? There appears to be no one here to do so.

The Chairman—Mr. Harrod, what changes have been made in the design of the work since the adoption of the reports and plans?

Mr. Harrod—I know of no changes in the work, except minor changes and such as we were authorized and placed within the discretion of the Drainage Commission and the engineer by the Act of Legislature and the specifications. These changes, I believe, have been to the advantage of the work, either with a view of its efficiency or its economy. There was a change made several years ago concerning which the original members of the Advisory Board of Engineers were consulted. This change was approved by them, and also subsequent changes have been made on that line. Recomputations have been made of the work of run-offs and the discharge capacity of conduits, and in some cases the conduits have been enlarged and in others decreased.

The Chairman asked Mr. Walmsley who was to be summoned before the Board.

Mr. Walmsley—Anyone that they wished to send for who had any complaints to make.

The Chairman—What length of time would be necessary to give notice to the parties to appear?

Mr. Walmsley—Twelve hours would be all that would be necessary, as this matter had been before the public and press for the past month or six weeks.

A motion was made and seconded to call upon Mr. Brown to be present at a meeting at 9 o'clock Saturday morning.

A motion was also made that notice be sent out through the public press to all who were concerned in this matter to present such material evidence as they have in possession or which they know to be in existence and present same here at 2 o'clock to-morrow afternoon. This motion was seconded and adopted.

The public meeting adjourned at 2 o'clock.

NEW ORLEANS, March 15, 1902, 9 A. M.

The Chairman opened the meeting by stating that he understood informally that Mr. Brown will not be here this morning in response to his notification of yesterday.

Mr. Jamison will be here in a few moments and he will tell us what he has learned in the matter.

The Chairman—Mr. Jamison have you anything to report concerning the result of your effort to obtain Mr. Brown's presence at the meeting.

Mr. Jamison—Nothing except that he would send a letter here by 9 o'clock this morning, and that he would leave town this morning.

The Chairman—Did he state how long he would remain away? Did you see him in person? Was the letter to be addressed to this office?

Mr. Jamison—Mr. Brown would be away all day, and the letter was to be addressed to the Chairman at this office.

The Chairman asked Mr. Jamison to kindly ascertain if the letter had been received.

Mr. Jamison replied that it had not been received at that office but suggested that probably it had been sent elsewhere.

The Chairman—Is there anyone here having a communication to make charging departures from plans or from original specified character of work? There seems to be nobody here to do so.

The Chairman—Mr. Harrod, have you anything to say on the subject?

Mr. Harrod—No.

Mr. Benzenberg suggested that they wait for the letter from Mr. Brown.

The Chairman said that probably the letter would be delivered by special delivery, but Mr. Jamison thought it would be sent by Mr. Brown's special clerk.

Mr. Benzenberg—I suppose that it is in order to approve the minutes of the meeting of yesterday.

The minutes were then approved as presented.

The Chairman—Has anyone now present any statement to make, as we have a great deal to do in the way of looking over the documents on hand?

Mr. Carson moved that a recess be taken for a half hour, as Mr. Brown's letter might arrive at that time.

The motion was seconded and the Board took a recess for one half hour.

After the meeting was again in session, the Chairman said: So long as the request for Mr. Brown's presence is to be answered by letter which can be taken up at any time, do you not think that we can adjourn until this afternoon at 2 o'clock? The letter can then be taken up, and there will be no one inconvenienced by our waiting until then. Of course, if there is any one present who will be inconvenienced by waiting, we could take it up as soon as it came. If it is agreeable to you we will adjourn to meet this afternoon at 2 o'clock.

The meeting adjourned at ten minutes of ten o'clock.

A few moments later Mr. Jamison brought the letter from Mr. Brown, and the Board re-convened to hear the communication.

The Chairman—We have received what was promised us yesterday, the official document of Mr. Brown's letter published in the Times-Democrat of February 10th, regarding Cement and Drainage.

Mr. Jamison then read Mr. Brown's letter.

The Chairman—Gentlemen, we have heard Mr. Brown's letter, have you any suggestions to make regarding same?

Mr. Benzenberg moved that it be received and Mr. Brown requested to appear before the Board for the reason that his letter clearly states that he is familiar and deeply interested with the progress of the work, and aware of departures, and that, there-

fore, he can facilitate our work very materially by pointing out such departures to us.

The Chairman then asked if there was anyone present who was conversant with the features that we are called in here to examine?

There was no response to this question.

Mr. Carson—I feel a little in doubt as to Mr. Brown's statement in his letter, and would rather have it lie over for a little time, say until this afternoon. As he refused to come, I do not know whether we should ask him again.

The Chairman did not think there was any great hurry, and submitted the motion to have it lie over for consideration.

It was stated that if Mr. Brown had made any specified complaint that same could be investigated immediately.

The Chairman answered, that Mr. Brown had made one complaint, the change of the subchannel.

The Chairman—As the Chief Engineer is present why cannot we take that one item up and obtain from him his views.

Mr. Harrod did not respond.

The Chairman then said, that, according to his recollection, the suggestion of a change in the subchannel was brought up at the time the Advisory Board met and was approved by them, which he thought was confirmed by Mr. Harrod.

Mr. Benzenberg—I think that he ought not to take this matter up at the present time, but wait until we have all of the various departures from plans or from original specified character of work presented to us.

The motion was then made that if there was no particular matter to be gone over, that the Board adjourn until 2 o'clock this afternoon. This motion was seconded, and the Board adjourned its public session.

NEW ORLEANS, March 15, 1902, 2 P. M.

The afternoon session was called to order at 2 o'clock.

The Chairman stated that the Board had given notice that they were ready to hear from anyone who had charges to make against

the original plans, and that they would hear them in such matters this afternoon.

The Chairman—Is there anyone here to present anything to that effect? There seems to be no one.

The Chairman then stated: Of course we can proceed without such information, as we have certain documents which have been given us containing information on that line, but we would be very much facilitated in our work and our time saved if such charges were presented promptly.

Mr. Carson stated that he asked this morning that the statement of Mr. Brown be delayed, but afterwards it occurred to him that as Mr. Brown had been requested to appear and he having declined, and referred to former letters that we must act simply upon his letters, but thinking the matter over it seems to him that Mr. Benzenberg's motion was right. He said: I concur with it and would like very much to have it taken up, and I move that it be passed. This was done.

Mr. Carson then added to the motion that the Chairman write another letter pointing out Mr. Brown's statement that as he is deeply interested in the work and was aware of departures, it would facilitate our progress if he is present.

Mr. Benzenberg added that the reasons that Mr. Brown could assist were, that he having studied this public work for so many years is more intimately acquainted with all its details than either Mr. Carson or he himself could hope to become acquainted with. The Chairman is also somewhat familiar with the work, but Mr. Brown may be able to point out to us some feature of departure which we might pass for lack of study, familiarity and appreciation and not discover as readily as he could point same out to us, and for that reason he should be asked to place the matter at our disposal.

The Chairman then stated that the remarks were very appropriate and he endorsed the writing of another letter.

The Chairman then asked Mr. Yenni if he had any statement to make. He answered no.

Mr. Carson then addressed the Chairman: As a representative of the National Contracting Co. is present, I would move that he be requested to furnish us with such documents as he can, namely,

The Chairman stated that a number of other names had been given and it might be well to verify their statements:

Mr. Benzenberg then stated that it seemed to him that there should be a time fixed after which we would not be able to take any further public evidence in the matter, or else our time will be used up indefinitely in this work, and would suggest that we state in some public manner that after a certain time we would not be in a position to continue taking statements, making charges or calling attention to departures. By doing this we can then take up the other side of the question and devote our time to examining the work, specifications and plans. There is a great deal of work to be done and if our time is to be taken up in this way we will never get through with it. If we can get all the information we can fix a limit of time.

The Chairman then stated that the Board had sufficient information before them so that they could go right ahead with the work and examine same.

The question was asked what limit of time should be given to parties to appear, and the Chair stated that he thought up to 4 o'clock on Monday would be time enough.

The Chairman then asked Mr. Jamison if Mr. Brown would return to-morrow?

Mr. Jamison said that he did not know whether he would or not.

Mr. Benzenberg suggested that the Board need not wait for Mr. Brown's return but go right ahead.

Mr. Carson agreed with Mr. Benzenberg and said that he did not see why the Board could not proceed as suggested. He also said that he would like to leave the city as soon as he could, and not later than next week.

The Chairman asked what time would be best for the public to appear, Tuesday or Wednesday, as we need the rest of the week to finish the work.

Mr. Carson asked the Chair if he had any particular day in mind?

The Chair answered that he would suggest that we lengthen the time to listen to anyone who had charges to make referring to departures until Monday afternoon, and after Monday would

take up such evidence as could be submitted on the side of the defense, if there is such. How much is going to be given on that side, I do not know, and if there is sufficient publicity I do not see why we should not have all parties here on Monday.

Mr. Carson stated that Mr. Walmsley said that this matter had been ventilated through the press for some six weeks, and it was well known that this investigation was to be held. A notice was placed in this morning's papers, and if it is put in Sunday's and Monday's papers this ought to be sufficient time.

Mr. Benzenberg said: Mr. Chairman, you have the names of two gentlemen who are said to have some information relative to charges to be made, and I move that they be required to be present on Monday forenoon or Monday afternoon, they suiting their own convenience.

Then the question was asked if these gentlemen would bring anything in the way of papers with them?

The Chairman stated that if there were no further matters of importance to be brought before the Board he would hear a motion to adjourn. This was moved and seconded.

On the information given by Mr. Venable that Pumping Station No. 2 is in condition to be examined, the Board adjourned to go down there, and asked Mr. Venable and Mr. Harrod to accompany them.

NEW ORLEANS, MARCH 17th, 1902. 9 a. m.

The Chairman—Mr. Jamison, did you receive any communication from Mr. Brown in answer to our letter of Saturday?

Mr. Jamison—No.

The Chairman—Mr. Fisher is here who desires to give us some information, which we understand he possesses.

Mr. Fisher—I desire to ask what information is wanted?

The Chairman—We understood that you had something to say on the subject that we are inquiring into here, and ask you to kindly come forward and communicate same.

Mr. Fisher—I have nothing special to say except in the interest

of true Portland Cement, and know nothing of interest concerning this investigation.

The Chairman—You say you are interested in Portland Cement?

Mr. Fisher—At that time I was interested.

The Chairman—At what time?

Mr. Fisher—I have been interested in the sale of this cement up to the beginning of this year, and now handle American Cement.

The Chairman—Did you make any statement concerning the use of Portland Cement or American Cement in this work?

Mr. Fisher—I did not. You ask me to make a statement, but I would like to make an explanation. I had an interview in the newspaper, entirely unsolicited on my part, and with the representative of the Illinois Steel Co., and I would like to refer to same. Some specifications which were lying on my desk which I understood were the specifications under which the Steel Portland Cement was being tested, and I claimed that those specifications did not represent a true Portland Cement. The gentleman replied, smilingly, that those specifications were prepared in the office of the Illinois Steel Co.

The Chairman—What was this gentleman's name?

Mr. Fisher—Mr. Affleck, a representative of the Illinois Steel Co., and residing in St. Louis, Mo.

The Chairman—Is Mr. Affleck in the city, and could he be communicated with?

Mr. Fisher—I do not know.

Mr. Fisher—I consider that the question as to who prepared those specifications was a matter of no moment, and, further, that an engineer who was asked to use an article that he was not familiar with was perfectly justified in asking for some data on that article, which in the case of cement would be a specification, and that after he had approved that specification it became his. Any information that I could give I would do so, but from what I read in one of the papers, the object was to speak of the price of cement at that time.

The Chairman—Have you any information on that subject? We should like very much to have this information if you can give it to us.

Mr. Benzenberg—At what time did this interview you had with Affleck take place?

Mr. Fisher—It was about four o'clock in the evening last July, the day before the bids of the last contract was opened, and it was in my office. The talk was in a general way.

Mr. Benzenberg—Was the subject then opened as to the contract for which bids were being made?

Mr. Fisher—No.

Mr. Benzenberg—Did the specifications which you had lying on your desk and to which you referred, have any connection with cement used in this work?

Mr. Fisher—They referred to the contracts of '95 or '96. In this connection I would like to state that the specifications for the last contracts, 1901, were copies of those for Steel Cements with the exception that the word "imported" was substituted for the word "steel," and that the weight of the barrel differed. The analysis, however, for this Imported Portland Cement called for 50 to 65 per cent. of lime and 20 to 29 per cent. of silica, and I think you gentlemen will agree with me that no Portland Cement could contain as low a percentage of lime as 50, and as high a percentage of Silica as 29.

Mr. Benzenberg—Did you say that in this last specification the word "imported" had been inserted?

Mr. Fisher—So far as my memory serves me the specifications read: Specifications for Imported Portland Cement to be used in connection with the work of the Drainage Commission, or something of that sort.

The specifications for the old contracts of '96 you will see read about similar, but with the exception of the word "Imported"; and in the description in the first paragraph of these specifications of '96 the word "Steel" was introduced in connection with cement.

Mr. Benzenberg—Did you say '96 specifications?

Mr. Fisher—I mean the specifications under which the cement was tested, not the specifications as they were given to contractors, as I understand those specifications were very brief.

The Chairman—As I understand the matter after the contracts were made in '96 the contractors were given more complete and detailed specifications with regard to cement.

Mr. Benzenberg—About what time was this?

Mr. Fisher—I do not know, but think it was about the time that the cement was being used.

Mr. Benzenberg—Was Steel Cement being used at that time?

Mr. Fisher—Yes.

Mr. Benzenberg—What time did you say those specifications were made?

Mr. Fisher—I have no definite information on that point, but think it must have been about the time that the Steel Cement was first used.

Mr. Benzenberg—You have a copy of those specifications?

Mr. Fisher—I did not have a copy of those specifications until some time later in the year, as I had no interest in the matter.

The Chairman—Did you compare the specifications which you had with the ones of Mr. Affleck?

Mr. Fisher—The specifications that I had lying on my desk and which I showed Mr. Affleck as being the specifications under which the cement was being supplied for this work, he claimed was prepared in the office of the Illinois Steel Co.

The Chairman—Those were the more detailed specifications to which you have referred?

Mr. Benzenberg—Were the specifications you had then all that the detailed specifications prepared after the award of the contract showed, or was it simply a part of those detailed specifications?

Mr. Fisher—It was a copy.

The Chairman—Have you such a copy here with you?

Mr. Fisher—No; but I can get it. The one that I have is a copy and I have verified it.

The Chairman—Are these a copy of the specifications?

Mr. Fisher—I can identify them and recognize the various different clauses which were made in the specifications.

Mr. Venable—These have been verified by Mr. Jamison.

The Chairman—Did you ever furnish any cement for this work?

Mr. Fisher—No, sir.

The Chairman—Can you give us a list of the prices? I suppose you made bids for furnishing cement to contractors under

this work? Were you handling Imported Portland Cement and also other brands?

Mr. Fisher—At that time I was handling the Porta, Kaiser, and sundry Belgium brands.

Mr. Carson—Did those come in bulk or package?

Mr. Fisher—In barrels.

Mr. Carson—Were they barrelled here?

Mr. Fisher—No.

The Chairman—Do you handle much of Portland Cement?

Mr. Fisher—Very little, because the domestic article has proven equal to the foreign article and preference is given to the home article.

Mr. Carson—How many years since that condition has prevailed in your opinion?

Mr. Fisher—This has been gradually taking place for fifteen years, but owing to various freight difficulties and the advantage which we had here in getting Imported Cement, it has only been during the past twelve or eighteen months that American Cement has come into this market.

The Chairman—Did you give prices in writing to the contractors?

Mr. Fisher—I do not believe I did. I made them orally. Mr. Mullen spoke on the subject and I gave prices to him verbally.

The Chairman—You have sold a good deal of cement here?

Mr. Fisher—Here, and all over the country as far as the Rocky Mountains, Denver, and as far East as Atlanta.

The Chairman—Did you ever sell any for Government contracts?

Mr. Fisher—Yes; I had a large contract with the Government for work at Fort St. Philip. This Fort was built entirely with the cement which I furnished them. I furnished them with the two brands which I have mentioned.

The Chairman—Was it furnished direct?

Mr. Fisher—Yes. My first contract was with J. B. Quinn, Chief Engineer.

Mr. Carson—That was in what year?

Mr. Fisher—It was about '96. I sold Mr. Quinn 4,000 barrels, with the privilege of increasing or reducing it 20 per cent.

The Chairman—Was that under contract or open bid?

Mr. Fisher—Open bid. I was the lowest bidder. I can give you a copy of the bids should you desire them. I sold the 4,000 barrels at $2.55 delivered at Fort St. Philip, and it cost me 25c. to lighter it there, making a net price of $2.30. The Government took the extra 20 per cent, making a total of 4,800 barrels, and they bought about 7,000 barrels more from me for the same work, which I delivered direct by steamer to Fort St. Philip, stopping two steamers to discharge. This was sold at $2.20. Those were about the ruling prices of my cement at that time.

The Chairman—What year?

Mr. Fisher—In '96.

The Chairman—Did you say that you could give us the prices of cement subsequently and to the present time?

Mr. Fisher—I can.

The Chairman—Can you give it to us now?

Mr. Fisher—Yes; orally. If you prefer it in writing I can give it later.

The Chairman—I prefer it in writing.

Mr. Fisher—I can say that the prices have run about the same with the exception of Steel Cement, which was at that time considerably higher.

The Chairman—I suppose prices would depend on the lots and whether it could be delivered direct or from warehouse.

The Chairman—Would it not be a saving in cost if it were delivered direct?

Mr. Fisher—Yes. It would be cheaper if taken ex-ship and in large lots.

The Chairman—Will you give us the prices at which you sold cement to the Government and to other parties?

Mr. Fisher—I will be willing to give you all the information I can in regard to sales to the Government and any other public sales I have made.

The Chairman—We are only interested in large sales.

Mr. Fisher—As most of my large sales have been to the Government, I will confine myself to that, but if it would be of interest I could give you copies of bids made by others on different brands.

There is sometime some little favoritism given for some special brand.

The Chairman—Can you furnish the Government specifications?

Mr. Fisher—I think I can; in some cases if not in all.

The Chairman—Has Mr. Fisher anything else to state?

Mr. Fisher—I can think of nothing else at present. I only hope that you gentlemen fully understand my position in this matter. I am only interested in the price of Portland Cement. The matter connected with the drainage has but little interest to me.

The Chairman—Are you selling Imported Portland Cement now?

Mr. Fisher—No; I am selling the American Portland Cement.

The Chairman—Are you handling any other brands of cement?

Mr. Fisher—No; but if a party ordered another cement as Louisville cement, I would furnish it, but I am not pushing other brands.

The Chairman—Did you ever sell any Slag Portland Cement?

Mr. Fisher—I made a contract for it once, but it fell through.

The Chairman—Was it in connection with any public work?

Mr. Fisher—It was in connection with a public work, but I decline to state what.

The Chairman—Has Mr. Harrod anything to ask Mr. Fisher?

Mr. Harrod—I think not.

The Chairman—Is there anyone here who has anything to say regarding departures from the plans or from the character of the work as originally specified? There seems to be no one.

The Chairman—Mr. Venable, have you anything to state?

Mr. Venable—I have nothing that I consider of any importance to say relating to the character of the work. I can furnish the Board with a number of changes that have been made, but I myself have no criticism to make. I can also furnish the Board with some changes that have been made in contracts differing from the original specifications which have effected the progress of the work, but I would not submit those, for if any difficulties came up they would be laid at the company's door which I represent. I would like to submit to you some papers, first: a letter of Major Harrod submitting specifications for the use of Steel Portland Cement; second, those specifications, and third, our contract with

the Illinois Steel Co., and I would like to call particular attention to the fact that we did not contract with the Illinois Steel Co. until after it had been authorized in a proper manner. The Secretary has verified those papers.

Mr. Carson—Mr. Chairman, my mind is not quite clear as to the situation. I understood that Mr. Venable knew of departures which had been made from the original plans.

The Chairman—He does know of departures but does not wish to submit them until we ask for them. Is it advisable to ask for them? We can get this information from the Chief Engineer of the work, as he is familiar with the changes in the work.

Mr. Benzenberg—I think we have advised the public that we would like to have anyone appear before us who knew of departures, but we have had no response.

Mr. Carson—Can Mr. Venable give us a list of departures this evening?

Mr. Venable—I have them prepared but not typewritten, but I do not wish to appear as an interested party, for should difficulties come up it would be laid at our company's door, and I think any other objection should be made by some other party.

The Chairman—I would like to ask Mr. Harrod if he could furnish us with copies of plans referred to in the general specifications and which were approved by the Advisory Board of Engineers on Dec. 27, 1895?

Mr. Harrod—I can furnish you with those plans approved by the Advisory Board of Engineers.

Mr. Benzenberg—Accompanying each set of specifications running from section A to section Q must be a set of plans. Are they so we can receive and examine them?

Mr. Harrod—Yes. The first set is ready but the other may take some little time to prepare.

Mr. Benzenberg—Can we get the first set this morning?

Mr. Harrod—Yes.

The Chairman—I would be glad if the Drainage Commission would furnish us with a general plan showing the present situation of the progress of the work, and which would also show general deviations that have been made from original plans and difference in sizes exhibited on that plan.

Mr. Harrod—It will take some little time to furnish you with the same; perhaps a day or more.

Mr. Carson—I move that Mr. Jamison be requested to furnish the Board with same. This was seconded and adopted.

The Chairman—Can you furnish us with plan No. 4 with changes on it?

Mr. Harrod—If you desire same.

The Chairman—I suggest that we divide these questions into two parts and take up each one.

The motion was made to adjourn until 2 o'clock, which was adopted.

NEW ORLEANS, MARCH 17th, 1902. 2 p. m.

The Chairman—Mr. Jamison, have you received any communication from Mr. Brown?

Mr. Jamison—None whatever.

The Chairman—Do you know whether he is in town?

Mr. Jamison—I was told that he was.

The Chairman—We have received the communication promised us this morning from Capt. Venable, the local manager of the National Contracting Co., regarding changes which have been made in the plans and specifications as originally prepared. Will the Secretary read it?

Mr. Jamison then read the communication which was marked Exhibit B.

The Chairman—Has Mr. Venable anything to state?

Mr. Venable—I do not think that many of the changes apply to the investigation, as they had been settled by the Arbitration Board.

The Chairman—What changes were made in covering?

Mr. Venable—In the contract of 1901 I adopted concrete and steel slabs instead of brick arches. This change was submitted to the Drainage Board and approved by them.

The Chairman—Was any royalty paid?

Mr. Venable—Yes.

The Chairman—Do you know how much was saved in the cost?

Mr. Venable—No. I have not figured it out, but the Chief Engineer can tell you. It was a great saving in expense.

Several gentlemen are to be notified to be present at the meeting at 9 o'clock to-morrow morning: Messrs. Richardson, Kirkland, Earl and Prof. Creighton.

The Chairman—Mr. Venable, when did you begin to use Steel Portland Cement?

Mr. Venable—At the very beginning of the work. The contract was made with the Illinois Steel Co. after the cement had been subjected to test and approval.

The Chairman—Under what date was that?

Mr. Venable—September 8th, 1897, was the date of the contract and tests were made as long as the cement was used.

The Chairman—Have you anything else to say?

Mr. Venable—No, sir.

The Chairman—Mr. Harrod, will you kindly state what departures in the plans and specifications from the original have been made in your point of view?

Mr. Harrod—You asked me for that information this morning and I have prepared some of it. He submitted a memorandum of changes accompanied by plans.

1st. Exhibit B shows list of changes of locations and alignments, with red lines showing changes. Exhibit D where red lines show progress of construction. These were prepared in the office of the Drainage Commission. Some changes have been made in the dimensions and grades.

First change noted is the one of the pumping station No. 8 that is at the intersection of London Ave. and Monroe Ave. This was omitted by the Advisory Board before the completion of the plans, the station having been considered unnecessary.

Second change was made in the location of pumping station No. 3 with the view of making the discharge into Lake Pontchartrain more direct.

Third change in the Canal from Broad to Marigny Ave., connecting with station No. 3.

Fourth, change in location of pumping station No. 1. This matter was referred to the Drainage Commission and authorized by them.

Fifth, change made by the authority of the Drainage Commission, in the location of pumping station No. 6. It was moved back 1,200 or 1,500 feet towards the Lake with the object of bringing it immediately on the line of the N. O. & W. R. R., a belt road, by which it could be furnished with materials and supplies.

Sixth, change was made in the Third Street System by the Drainage Commission on the recommendation of the Engineer. The moving of the Canal on Carondelet St. between Toledano and Felicity to St. Charles was with the view of moving it from a very narrow street which was already occupied by a line of tracks of street railroad and valuable trees to St. Charles, where there was ample space to construct it without damage or cost.

Seventh, a new Canal was put in Perrier St., instead of enlarging the old one on Pitt street. This was done to improve the drainage of this locality, which is probably the worst provided for of any in the city.

Eighth, the conduit in the plans located on Jeanette street was moved to Birch to avoid a large number of tracks entering the barn of one of the City Railroad Companies.

Ninth, a change was made in the location of the Canal on Burgundy street to Rampart and St. Claude with the intention of avoiding car lines and asphalt pavements which would have to be removed and replaced.

The Tulane Canal leading from Galvez to Caiborne, as shown on map No. 4, was omitted with the authority of the Advisory Board before its adjournment. I know of no other changes in alignment.

Mr. Benzenberg—Was the cost of the work increased by the changes made in pumping plants and canals Nos. 3, 1 and 6?

Mr. Harrod—No. I think every change that I have recited was made after study and consideration with the view of preservation, efficiency of the system and its economy. The work has been done cheaper and in every case equally as good.

Mr. Benzenberg—In the change in location of No. 3 pumping station or the change from Burgundy to St. Claude and Rampart, and the change from Jeanette to Birch, has the cost of work been increased on the unit system?

Mr. Harrod—No. They have not increased the cost on the unit system, but they have avoided obstructions in the way of railroad tracks and pavements that would have had to be replaced at an additional cost.

Mr. Benzenberg—Have they effected the strength or impaired the efficiency of the system?

Mr. Harrod—No. Some of them have improved it, especially the Canal or Perrier street. The change was made after careful study.

Mr. Benzenberg—Were these changes made after the contracts were let, or before.

Mr. Harrod—I will have to look over the list. Changes in pumping stations Nos. 8, 3, 1 and 6 were made before the contracts were let. The change in Carondelet, a part of the Third street system, and the changes in Perrier, Jeanette and Burgundy were also made before the contracts were let.

Mr. Benzenberg—Were all these changes made with the knowledge of the Commission?

Mr. Harrod—Yes.

The Chairman—As to grades and slopes, what changes have been made?

Mr. Harrod—I am not prepared to say, but I can have that tabulated. The change in the St. Louis Canal involved a uniform slope increased from .0005 to .00057.

The Chairman—Was this the increase for the ordinary flow?

Mr. Harrod—The aggregate fall from the head of the system to the pumping station necessarily remained the same, but re-distribution of the slope may have been necessary at different parts of its length. In the St. Louis Canal there was a drop in the bottom of the original plans, but this has been eliminated which increased the uniform slope of both surface and bottom. Besides this no other important change of slope has been made.

The Chairman—Now with reference to width of the channel, what changes have been made?

Mr. Harrod—I have looked at the plan of the St. Louis Canal and find the width there is 25 ft., the original was 28 ft. This change was made with the sanction of the original Advisory

Board and agreed to by them. 28 ft. was the old width and the constructed width was 25 ft.

The Chairman—When was the change in the subchannel made?

Mr. Harrod—I will report on that later.

The Chairman—Do you know of any other changes in width?

Mr. Harrod—I think there have been some slight changes right along, in one direction or another.

The Chairman—The changes in width were all then made with the sanction of the Advisory Board?

Mr. Harrod—They were made subsequent to the adjournment of the Advisory Board and whatever changes were made were on the line of that advised in the St. Louis Canal or were the results of further computations and observations.

Mr. Benzenberg—How long has the St. Louis Canal System been completed?

Mr. Harrod—That Canal was finished during 1898, but its efficiency was not tested on account of the failure of pumping station No. 2, on account of the deposits which accumulated in the Canal.

The Chairman—Was there ever anything said about decreasing the width of St. Louis Canal by Mr. Brown or anyone?

Mr. Harrod—No. I have heard of no criticism excepting those of Mr. Brown, who did not approve of any changes whatever, and he sent a letter of protest.

Mr. Benzenberg—Was it a general disapproval on his part?

Mr. Harrod—Yes.

Mr. Benzenberg—No specific reasons?

Mr. Harrod—I do not recall them.

The Chairman—What changes were made in the subchannel?

Mr. Harrod—It was omitted.

Mr. Benzenberg—Were there any changes in the width of the Canal?

Mr. Harrod—The reduction in width was not made until after Claiborne street was passed.

The Chairman—With reference to the omission of the subchannel in the St. Louis Canal, as the matter is undoubtedly fresher in your mind than in mine, will you kindly state what were the reasons why the subchannel was not built?

Mr. Harrod—Of course; it was intended for only a dry weather

flow and did not pretend to have any capacity for heavy rains. In the excavation of the St. Louis Canal there was great difficulty in shaping the inclined slope at the bottom of the canal, owing to the character of the material. It was therefore impracticable, without a cost and risk far exceeding the value of the subchannel, to construct it, and for these reasons I advised its omission and the members of the Advisory Board concurred in this.

Mr. Benzenberg—Who agreed to this?

Mr. Harrod—Mr. Hering, Major Richardson and myself. I submitted their report among the documents handed you.

The Chairman—Have you constructed any other subchannel since this one was proposed?

Mr. Harrod—No. My experience in building in this soil has led me to believe that a perfectly flat and level bottom and built up from that with a sufficient depth of concrete to hold the invert, and then a brick wall on top of the concrete is the best method of construction.

The Chairman—Can you give us an estimate of the amount of work that has been done?

Mr. Harrod—In my reply to the Progressive Union I made a statement that more than 55 or 60 per cent of the work had been done at less than one-half of the estimated cost. I have made no other estimates of the work under contract or under advertisement.

Mr. Benzenberg—When you speak of 50 or 60 per cent of the work being done, to what do you refer.

Mr. Harrod—I have reference to the work estimated in the report of the Advisory Board amounting to a little less than $8,000,000.

The Chairman—Was the canal on Broad street the main outfall left to be built last?

Mr. Harrod—Yes, as recommended by the Advisory Board.

The Chairman—Why?

Mr. Harrod—Because the city would have been benefitted by building the other canals first.

The Chairman—Was the main canal leading to Lake Borgne so far constructed in accordance with the plans of the Advisory Board?

Mr. Harrod—Yes. If the money had been spent in construct-

ing the main canal a large portion of the city would not have been benefited.

The Chairman—Were the canals leading to Lake Pontchartrain, and the main canal leading to Lake Borgue, constructed according to the dimensions indicated in the original report of the Advisory Board?

Mr. Harrod—Yes. The lower part of the main canal was constructed at an early period for the reason of complaints that the Jourdan Ave. pumping station caused overflows on the swamp lands in the rear. To abate this complaint this portion of the work known as the main outfall canal was constructed to convey the discharge of the Jourdan Ave. station directly to Bayou Bienvenue, and the excavated earth was shaped into a levee to protect the swamp lands.

The Chairman—What were the dimensions?

Mr. Harrod—Sixty feet wide.

The Chairman—What other part of the main canal has been constructed?

Mr. Harrod—From Jourdan Ave. to Elysian Fields, and as before stated from Jourdan Ave. to Bayou Bienvenue.

The Chairman—Was the main canal constructed in accordance with the plans as advised in the 1895 report of the Advisory Board?

Mr. Harrod—Yes.

Mr. Benzenberg—In your opinion and from your knowledge of the requirements of the main canal running from Elysian Fields to the meeting of Claiborne and Nashville Ave., what was the estimated cost in dollars and cents to construct it?

Mr. Harrod—I should think from one million and a quarter to a million and a half.

The Chairman—Is the section of canal just mentioned the only large canal that remains to be constructed so as to carry out the whole drainage system as originally planned, excepting the minor work?

Mr. Harrod—No. In the back part of the city there are a number of open and unlined canals to be constructed which will be a part of the system. These will be very valuable and can be done very cheaply. In the main part of the city the most important system is the Napoleon Ave. system, and the main canal from

Nashville Ave. to Elysian Fields. It is proposed to line and cover it to Lapeyrouse street, which is five blocks below Esplanade, from that point East it will be left open and unlined.

Mr. Benzenberg—Is this all that is necessary to complete the principal feature of the Drainage System as placed before the Advisory Board of Engineers and agreed to by them?

Mr. Harrod—I have mentioned the Napoleon Ave. system, and besides this is a pumping station, No. 4, which is an essential part of the system and for which no provision has as yet been made. In addition to this whenever the main canal on Broad street is finished additional pumps will have to be placed in stations Nos. 1, 2, 3 and 4. The first three of these stations as constructed are ready for the placing of these additional pumps whenever the final outfall into Lake Borgne is carried out.

The Chairman—As there is no one here to bring any objections and it now being twenty minutes of four and a limit of time having been set to receive charges of departures, etc., will Mr. Harrod make the statement he desired to make before us?

Mr. Carson—Will Mr. Harrod confirm the changes mentioned in Exhibit B of Capt. Venable? 1st, marked "a", change of route of the Toulouse canal. 2nd, marked "b", increase of lift of pumps at station No. 2; and 3rd, marked "d", the use of sheet piling? Were they confirmed by agreement between the Drainage Commission and the National Contracting Co.?

Mr. Harrod—Yes. Increase in lifting of pumping station No. 2 was made by the adoption of the recommendation of the Board of Arbitration. The use of sheet piling was no change. There was a contention between the Drainage Commission and Contractor, which was settled by the Board of Arbitration.

"e" shows use of gravel instead of Lake shells in the concrete. Shells were allowed in construction formerly by the Engineer. Concrete slab covers were substituted for eye beams under contract of 1901 by the Engineer in the specifications, as being a better and cheaper construction.

The Chairman—This change was made by you?

Mr. Harrod—I will submit this subject later. There was no material specified for concrete, and when the proposal came to make the change I allowed its use gladly.

The Chairman—The increase in lift of pumps was authorized by the Drainage Board?

Mr. Harrod—Yes. It was 2 ft. at first and that was made 3 ft.; we got into a controversy with the contractors and the Arbitration Board made it 5 ft., and the Drainage Commission sanctioned this.

The Chairman—Now about the use of sheet piling?

Mr. Harrod—The specifications said the contractor should use such sheeting or sheet piling as the Engineer authorized and approved. There was some controversy over that, and the Arbitration Committee settled it by dividing it in half. I advised the use of sheeting where it could be done. After the Arbitration adjustment subsequent contracts contain a clause that the contractor himself should be responsible for all sheeting, sheet piling or other trench protection. In the contract of 1901 I adopted as a matter of general covering concrete and steel slabs as a substitute for brick arches. This change in plans and specifications were submitted to the Drainage Commission and received their approval.

The Chairman—Was this change made before the contracts for covering were approved by the Board?

Mr. Harrod—Yes.

The information promised by Mr. Fisher was then received.

The Chairman—Will Mr. Harrod continue his statement?

Mr. Harrod—On receiving the questions submitted to me by a newspaper, I immediately went to the Attorney of the Board and with him to the President of the Commission, and with them to the Mayor. A meeting of the Drainage Commission was then held and a committee of investigation was appointed. I laid the facts before them, and they prepared a report and directed me to make a statement to the Drainage Commission at a meeting held on February 5th. The statement I made to the Drainage Commission is here marked G 6, and is in triplicate. I have an additional statement marked G 7, which is also in triplicate and is the only one I care to read. Mr. Harrod then read the statement.

Mr. Carson—At the time this request was made for the use of the cement called Steel Portland, did you then consult with anyone?

Mr. Harrod—Yes, with Prof. Creighton and other engineers.

Mr. Carson—What did they advise?

Mr. Harrod—They said it was a proper cement to use under the additional specifications.

Mr. Carson—Were you aware at that time the name Portland Cement as applied to Steel Cement was not a true Portland Cement?

Mr. Harrod—I did not. The distinction was brought to my knowledge by the report of the Board of U. S. Engineers composed of Messrs. Marshall, Leach and Bixby, who were appointed to report on specifications for cement in the work where the different kinds of cement was used.

Mr. Carson—Did you know, or have you ever heard of any parts of the work where the Steel Portland Cement was used that gave evidence of not being good?

Mr. Harrod—No.

Mr. Carson—From exterior surface examination does it appear just as good as that laid with true Portland Cement?

Mr. Harrod—As far as I know.

Mr. Carson—When was it used?

Mr. Harrod—It was used by the National Contracting Co. in 1897 and in the contracts of Collom & Co. in 1899.

Mr. Carson—Can you specify the contracts by letter?

Mr. Harrod—Yes. On contracts A. C. and F.

Mr. Carson—In the other contracts D. E. G., etc., did they provide for any other kind of cement than those specified in the general specifications for Imported Cement?

Mr. Harrod—D. was for open and unlined canals in which no cement was used.

Mr. Carson—Was this after the contracts were let?

Mr. Harrod—Yes. In all contracts subsequent to February bids were requested on Imported Portland Cement. After the letting, contractors were allowed to submit propositions for the rebate that they would allow the Drainage Commission in case the use of American Portland Cement was permitted in the place of Imported Portland Cement, and arrangements were based in these propositions to do the work at a reduced cost to the Drainage Commission.

Mr. Carson—In contracts A. C. F. was Steel Cement used entirely in place of Imported Cement?

Mr. Harrod—Yes. Some Portland Cement was used in surfacing the bottoms of canals.

Mr. Carson—Was Imported Portland Cement used where American Natural was specified?

Mr. Harrod—It was not distinctly specified where the different kinds of cement should be used. We had some trouble with American Natural Cement in very cold weather.

Mr. Carson—What did you do in that case?

Mr. Harrod—Substituted Steel Portland Cement.

Mr. Carson—You used Steel Portland Cement in some parts of the work where it was not specified?

Mr. Harrod—As I said before it was not distinctly specified in what parts of the work the different cements should be used, but after the trouble with the American Natural Cement, I increased the use of Steel Portland, which proved satisfactory.

Mr. Carson—In the use of Steel Portland Cement for American Natural was the contractor to receive any difference in pay?

Mr. Harrod—Yes. He received the unit price of his bid for the different material.

Mr. Benzenberg—I have not read the special specifications as yet and therefore ask did the special specifications marked A. C. and F. indicate what part of the work should be laid with Imported Portland Cement and what part should be laid with American Natural Cement?

Mr. Harrod—No. That was left to the Engineer.

Mr. Benzenberg—Will you furnish us with a copy of the unit price of this cement under contracts A. C. and F.?

Mr. Harrod—Yes.

Mr. Benzenberg—In all work that was done under your general direction, did you have inspectors who were in immediate charge of this work?

Mr. Harrod—Yes.

Mr. Benzenberg—Were they under your immediate supervision?

Mr. Harrod—Yes. They were appointed by me and subject to dismissal by me.

Mr. Benzenberg—Were they fully qualified?

Mr. Harrod—Yes. I had a civil service examination in my office.

Mr. Benzenberg—In this examination as to competency did you require knowledge of materials and work?

Mr. Harrod—Yes. Their experience on such work received consideration in their appointment.

Mr. Benzenberg—Did you have any trouble with any of your inspectors in this regard?

Mr. Harrod—No.

Mr. Benzenberg—To your knowledge they performed their duties fully up to the requirements?

Mr. Harrod—I have had a very reliable force with me most of the time.

Mr. Benzenberg—What was the condition of the work generally? Was it kept dry, or was it in wet condition?

Mr. Harrod—It was kept as dry as possible.

Mr. Benzenberg—Did the contractors to your knowledge at any time allow water to rise over the work when it was laid?

Mr. Harrod—They did not except where it was flooded by storms and could not be avoided. Water was not allowed to rise over it until it had set.

Mr. Benzenberg—I mean during the progress of the work, when they laid the concrete did they allow the water to run over?

Mr. Harrod—They kept their work well pumped down.

Mr. Benzenberg—Was the cement delivered here in barrels?

Mr. Harrod—No; in bags in carloads and carried to warehouses at the location of the work.

Mr. Benzenberg—Were the sheds where this cement was stored considered a good protection?

Mr. Harrod—Yes. They were raised from the ground and were tight sheds.

Mr. Benzenberg—What amount did the contractors keep on hand?

Mr. Harrod—They got a couple of carloads twice a week.

Mr. Benzenberg—How frequently were samples tested?

Mr. Harrod—Samples were taken exactly as called for in the general specifications; ten samples from every fifty barrels. We had one trouble of which I would like to speak. The cement was

so finely ground that it absorbed moisture unduly, and I was obliged to reject large quantities for that reason. I made my complaint and the Chicago people sent a special agent to investigate the matter.

Mr. Benzenberg—Did the taking of samples for the purpose of making tests give you enough time to determine the character of the cement before the cement was used in the work?

Mr. Harrod—Yes. At first the contractor kept enough on hand for that, and I made frequent re-tests. All were made by Prof. Creighton and he sent reports.

Mr. Benzenberg—How often did he send reports?

Mr. Harrod—About twice a week.

Mr. Benzenberg—Have you those reports and can you give them to us?

Mr. Harrod—Yes.

Mr. Benzenberg—How recently has Steel Cement tests been made?

Mr. Harrod—No tests of Steel Cement have been made since 1901, and it was only used on contracts A. C. and F.; those were the contracts of 1897 and 1899.

The Chairman—Did I see somewhere in the specifications that the Imported Cement was to be used for certain parts of the work?

Mr. Harrod—It was in the general specifications.

The Chairman—Did you use Steel Portland Cement more extensively than the Imported was to be used?

Mr. Harrod—That was what I wanted to be allowed to look up in my other office.

The Chairman—In reference to Mr. Brown's letter what did he mean by a certain statement that the plan of 1896 was practically annihilated as to stability and efficiency?

Mr. Harrod—I cannot tell you anything about that.

The Chairman—Can you tell what he meant by his statement of defects?

Mr. Harrod—I cannot.

Mr. Carson—Can a schedule of changes in widths, etc., of canals be made?

Mr. Harrod—Mr. Raymond, now deceased, had charge of the re-computations, but I will get the information and give it to you to-morrow.

The motion was made to adjourn until Tuesday morning at 9 o'clock. This was seconded and carried.

TESTIMONY OF CAPT. W. J. HARDEE.

CITY ENGINEER OF NEW ORLEANS, LA.

March 21st.

Mr. Hering—Capt. Hardee, are you at present City Engineer?

Capt. Hardee—Yes, sir.

Mr. Hering—How long have you been City Engineer?

Capt. Hardee—Since May 7th, 1900.

Mr. Hering—Are you familiar with the plans of the Drainage System that have been carried out by the Drainage Commission?

Capt. Hardee—Only in a general way and not as to details. At the time the plans were formulated and during the early days of construction, I was in the Government service. I have read the report of the Advisory Board of Engineers, but am familiar in a general way only with the plans; I have no knowledge whatever of the details, nor do I know whether there has been any departure in the actual work of construction from the original plans.

Mr. Hering—When you examined the plans, did you notice anything there which you thought was improper?

Capt. Hardee—If you have reference to the general plan, I must say that I have made sufficient study of them to indicate to me that they were not imperfectly prepared.

Mr. Hering—Do you believe that some of the changes, or all of the changes that have been made, have detracted from the efficiency of the original system?

Capt. Hardee—I have not kept in touch with the work, and don't know whether any changes have been made. Adverting to my last answer I will say that as far as my knowledge of the original plans extends, had I been charged with their preparation,

I do not know that I could have made better plans; in other words, the plans appeared to me to be the best that could be formulated to meet local conditions.

Mr. Hering—You have not heard of any diversion from the original plans that would injure the work?

Capt. Hardee—I do not know to my personal knowledge that there has been any change.

Mr. Hering—Have you ever been on any of the work, say, the construction of any of the canals?

Capt. Hardee—Yes, sir.

Mr. Hering—Did you examine the materials that were used and observed the character of the workmanship?

Capt. Hardee—I cannot say that I closely examined any of the materials. From my general observation I will say that the work impressed me as being substantial. I have at different occasions observed some of the work on the Third street conduit, the St. Charles street conduit, the Nashville avenue conduit, and the North Claiborne street conduit.

Mr. Hering—Did you notice any of the work in those places you mention to be defective in any way?

Capt. Hardee—No, sir. To the contrary I was impressed by the stability of the work.

Mr. Hering—Do you know what cement was used?

Capt. Hardee—Not to my own knowledge. I understand you want me to speak from my personal knowledge and not from hearsay.

Mr. Hering—Certainly. The bricks that were used on this work, how did they compare with the bricks that are generally used in other works?

Capt. Hardee—Very favorably. I saw the bricks not only in piles, but individually as being placed in the work. I also observed the sand and gravel; those two materials seemed to be the best of their kind procurable in the vicinity of New Orleans. As to the bricks I do not think it was practicable to get any better than I saw used. By practicable I mean within a reasonable radius of the city of New Orleans. What I have said of the materials applies to the conduits which I have mentioned; I have no knowledge of the conduits that were built in the early days.

Mr. Hering—Who were the contractors that built the conduits that you saw?

Capt. Hardee—Collom & Co. were the contractors for the Third street and St. Charles avenue conduits; Nash & Dowdle were the contractors for the Nashville avenue conduit, and the National Contracting Co. were the contractors for the North Claiborne avenue conduit.

Mr. Hering—Was Mr. L. W. Brown engineer for the National Contracting Co. when the conduits were built that you saw?

Capt. Hardee—Of that I am not positive, but I do not believe that he was. To the best of my knowledge, he severed his connection with that company several years ago; I think before the completion of the first contracts, or about that time.

Mr. Benzenberg—Capt. Hardee, in connection with your position as City Engineer, or otherwise in the City of New Orleans, have you had any experience that would make you acquainted with the nature of the soil such as would be encountered along St. Louis street, near pumping station No. 2?

Capt. Hardee—I have not seen any of that territory exposed much below the ground surface, but I have seen a considerable amount of penetration in the soil at different points throughout the city. While there is some variation, there is not a great deal in the general soil conditions.

Mr. Benzenberg—What is the character of the soil, say from 8 to 12 feet above Cairon Datum?

Capt. Hardee—Usually a stiff blue clay; sometimes you find the presence of sand quite marked, but generally a stiff blue clay. You will find the variation from sand to pure clay within very short distances.

Mr. Benzenberg—Do you know from your observations whether the soil at a depth of 12 to 15 feet below the surface of the street, say, of St. Louis street and Claiborne street, is of the character that would flow?

Capt. Hardee—I do not know, sir.

Mr. Benzenberg—Or of a character that would be difficult to support with ordinary bracing when excavated to a considerable depth?

Capt. Hardee—I cannot answer that question positively, since I

have never seen deep excavations in that particular locality.

Mr. Carson—We are particularly anxious to find any defects that may exist in the structures that have been built, and I therefore ask you, Capt. Hardee, if you know of any, such as broken walls, bad floors, bad concrete, bad roof, or any other structural defects?

Capt. Hardee—No, sir.; I know of none, and I qualify that by stating that the work I saw in progress impressed me as being very substantial and by comparison better than work of a similar character I have observed in Eastern and Western cities. I saw an intercepting sewer being constructed in Chicago last summer, which by comparison with the work I have observed here was very, very rough. The sewer referred to was a section of the large sewer on Thirty-ninth street. As near as I can recall, the bottom of the sewer was something like 35 or 40 feet below the surface of the street. I went to the bottom of the trench and carefully inspected some of the completed sewer and the work in progress.

Mr. Carson—As Engineer on Government work, or in connection with the City work, have you had experience with Steel Cement? I do not know what your experience with Government work may have been, but I know they have used Steel Cement and perhaps you had some connection with such work.

Capt. Hardee—I have never used Steel Cement on any Government work of which I have had charge, nor have I seen it used on any Government work. As City Engineer I have allowed its use in the concrete foundation of the House of Detention, which is quite a large jail structure that the City is now building, and also in the concrete foundation of two asphalt roadway pavements.

Mr. Carson—What has been your experience with that cement as to its quality compared with Imported Portland Cement?

Capt. Hardee—For foundation of roadway pavements I believe it to be superior to either Imported or Domestic Portland Cement, because of the fact that it is much tougher and less brittle I have never apprehended any trouble from its wearing properties where it is placed in a manner to be entirely excluded from contact with the air. The same statement practically applies to its use in the foundation of buildings, in fact I believe good slag cement to be

equal to any cement, either Domestic or Imported, and superior to many of them for sub-surface structures. I might cite an instance which I observed at the House of Detention, which would serve to illustrate the crushing or breaking strength of mortar made with Steel Cement: It was found necessary because of an error of dimensions to cut out a small amount of masonry which had been in place less than two weeks, and in removing it the bricks would break and crumble under the picks before the mortar would give way.

Mr. Carson—Would you or would you not hesitate to use Steel Cement in the construction of these drainage canals in preference to a general character of Imported Portland Cement?

Capt. Hardee—I unquestionably would not hesitate to use it in all parts of the conduit other than the roof. I would now entertain some apprehension about using it in the roof where metal was also employed, because of confidential information recently received from a source that I know to be entirely reliable and trustworthy. Before I came into possession of that information I should not have hesitated to have employed the Steel Cement in either mortar or concrete placed in direct contact with metal. I have learned of an instance, not in New Orleans, however, in which unknown to the engineer in charge, about 200 barrels of Steel Cement instead of Portland Cement, called for by the specifications, were used in mortar and concrete that was placed directly in contact with metal forming a roof. The sulphides in the Steel Cement corroded the metal and by chemical action caused the mortar and concrete in immediate proximity to the metal to disintegrate.

Mr. Hering—Do you know whether Steel Cement has been used in the roof of any of the drainage conduits?

Capt. Hardee—I do not know, sir. As previously stated I have no personal knowledge of what cements were used in building those conduits.

Mr. Benzenberg—Have you anything else that you can offer that would assist in getting additional light on this subject?

Capt. Hardee—I do not know of anything, though I might tender you gentlemen a bulletin (Exhibit "I") prepared by my chemist, showing the test of a number of brands of cements, samples of

which were submitted to my department. This bulletin, you will observe, furnishes both neat and sand tests for 24 hours, 7 days, 28 days, 3 months, and 6 months. I have found by comparison with tests of the same brands of cement made in other laboratories that the tests of my laboratory are generally lower, due more likely to manipulation of my chemist in making briquettes.

PROCEEDINGS OF THE MEETING OF THE BOARD OF ENQUIRY, HELD IN THE CITY OF NEW ORLEANS ON THIS, THE 20TH DAY OF MARCH, 1902.

MEMBERS OF THE BOARD.

Messrs. Hering (Chairman), Carson and Benzenberg.

WITNESSES.

Bell, A. C.....Page 2
Statement of Major Harrod.....Page 6

THURSDAY, MARCH 20th, 1902.

The Board met at 9 a. m., all the members being present.

The Chair—I have a letter here from Mr. Brown, in response to our last communication, which the Secretary will please read.

Letter read by the Secretary.

The Chair—So far as Mr. Brown is concerned, I suppose that ends the matter.

Mr. Carson—I move that, for the present, the letter of Mr. Brown be placed in the files of the Board. Adopted.

The Chair—Major Harrod, can you give us the formula, in sufficient brevity, according to which the original computations were made, so that we might understand the width or sectional areas that are recorded in the old specifications for the canals, and also the method of computation that you adopted for the revised figures that you gave us in answer to our request?

Major Harrod—The same formula was used as originally in the Kutter translation prepared by you and the others. The whole thing was re-computed with such a revision of character of run-

off as appealed to my chief assistant, who did the work, of course referring to me, but in a theoretical way of reaching conclusions, there was no change whatever, and I think an examination of those changes in width will show that there was no change beyond an effort to reduce the size to fit the conditions that were found to prevail after further study. The general trend is the same, narrowing the larger canals, and, in some places, a considerable enlargement of the smaller canals I don't recall any change at all, that was made, except the different values in these run offs in different sections. That, of course, is a personal condition that we have to meet in each case.

Q.—That is what I was coming to. The co-efficient of the run off of area was revised by you? A.—To some extent, yes, sir.

Q.—Can you tell us, according to that formula, upon what principle you proceeded in obtaining that run off, in making the revision? A.—No, sir; I cannot. We considered each run off by itself, and in some cases, as the changes show, changed its value We thought there would be more water mainly resulting from increase of settlement or building that was going on. Now the Nashville district that we visited yesterday, gave every promise of increasing in settlement much more rapidly than any other part of the city.

Q.—You therefore increased the run off per acre? A.—Yes, sir. Those were made some years ago, and I haven't had occasion to think of them at all, but I know there was no change made in the formula; simply in its application.

Q.—Where some of the larger ones were reduced? A.—Yes, sir.

Q.—And the question in my mind was, were they reduced because through the showing of some formula, that less water would accumulate in them, or was it due to the fact that the coefficient and smoothness which you provided in the sewers, was greater than originally assumed, which would likewise increase the velocity and reduce the sectional area correspondingly? A.—No, the coefficient in the Kutter formula was adhered to except where we used pipes. In some cases we extended the system a little further than the original plans show, by the use of clay pipes, 36 and then 30, I don't think any smaller than 30, but they extended the sys-

tem one or two blocks beyond where it had been originally designed, and for those pipes we used no lower coefficient than we did for the brick work, but what that was, I don't remember. The whole process was substantially the same that occurred in St. Louis street, when the Commission sent for you and Major Richardson to go back again and revise it. It was all laid before you at the time, and there was a unanimous concurrence in that change in the St. Louis canal, from 28 to 25, and following the same lines that were laid before you then, such changes as occurred. were made in other canals, with the result that some are a little wider and some a little narrower, the smaller ones being wider, and the larger ones, being narrower. Here are the plans that were submitted to bidders with duplicates of the maps showing the work under contract, completed and advertised.

TESTIMONY OF A. C. BELL.

The Chair—Mr. Bell, you were City Engineer of New Orleans for a term? A.—Yes, sir.

Q.—When was that? A.—From May, 1896, to May, 1900, four years.

Q.—Are you acquainted with the plans that were made by the Drainage Commission for a drainage system for this city? A.—Yes, sir; I studied those plans.

Q.—Were you on the ground to see what part of the work had been carried out, from time to time? A.—I followed the construction of the work from time to time, as far as my duties would permit.

Q.—Did you have anything to do, directly, with the carrying out of this work? A.—No, sir; none whatever. That was entirely under the charge of Major Harrod, Chief Engineer of the Commission.

Q.—Were you on the ground, however, sufficiently often as to be able to give an idea of the character of the work as it was progressing? A.—Yes.

Q.—Did you examine the materials, at any time, that they were putting in the work? A.—I examined them sufficiently to ascertain their character; to know that they were good and substantial materials.

Q.—Can you tell us whether any deviations have been made from the original plans which, you say, you are familiar with? A.—The only deviations that I was cognizant of, was the omission of the subchannel in the St. Louis canal, also the shifting further back of canal Carondelet, of the Toulouse canal and the digging out of the St. Louis canal from Broad to Hagan avenue, which I considered wise changes. I regarded the original location of the Toulouse canal as entirely too close to the Old Basin canal on account of leakage from the latter. Another change I noticed, was that from the Carondelet street canal to the St. Charles avenue canal; the change of location of the canal on Carondelet street, between Felicity Road, I think, and Jackson avenue. That was a change from Carondelet street to the river side of St. Charles avenue. And another change in construction that I noted, was that from the brick arch construction which was used on the St. Louis canal, the Basin street canal, Canal street, Chartres street and Camp street; on Third street, they used metal, and I notice that in recent construction they are using concrete. The reason for that change was, I presume, due to the fact that the gases carried out matter in suspension that would attack any steel exposed to its action.

Q.—Regarding any of these changes that were made, can you tell us whether there was any one, or more, which, in your opinion, detracted from the merit of the original plans in any way? A.—No, sir. I speak of the omission of the subchannel; of course I haven't investigated that to know whether that was a beneficial change, or not, but in regard to the Toulouse canal, I have already stated that I considered that change very beneficial. It decreased the cost of the work and also rendered the work safer. In regard to the change in the construction of the covers, I consider the change may have been very beneficial, for the reason that the steel is protected from acid and corrosion. The change from Carondelet street to St. Charles avenue I think was due to the reduced cost of construction of the work and also to prevent damage to the trees on that street. Carondelet street is a very narrow street, and there is also a street railroad track in the center, while St. Charles street is very wide and facilitated the construction of the canal.

Q.—Now as regards the character of the materials used in the work and the workmanship, what can you tell us about that? A.—From my observation I consider the character of the materials the best that could be gotten, and the workmanship, I considered very good.

Q.—Did you make any special examination of the cement used in this work? A.—I did not, sir.

Q.—Did you examine the cement in the drains, after it had been used and set? A.—No, sir; I made no examination.

Q.—Your opinion, then, is confined to the material before it was used? A.—Yes, sir.

Major Harrod—During your administration the city made connection with the main conduit on Canal street for some drains that you laid in connection with paving, and didn't you have an opportunity to observe then, the character of the masonry which you had to cut to make that connection, and did you, or not, gain any information about the character of the brick work, in cutting it? A.—No, sir; I did not. That was entirely in charge of Mr. Coleman.

The Chair—Who was Mr. Coleman? A.—Mr. Coleman was my chief assistant at the time that I was City Engineer. I was going to say, though, that the steel cement that has been spoken about, I have used for the foundations of public buildings, and I have also used the Illinois steel cement in the foundations of public buildings.

Q.—What has been your experience with it? A.—I consider it a good material where it is not exposed to the action of the air; covered, and in a moist place.

Mr. Benzenberg—Mr. Bell, you were over the work more or less, I understand, while you were City Engineer? A.—Yes, sir; but not as often as I could have wished, considering the importance of the work.

Q.—Were you over the work while the St. Louis canal was in progress? A.—Yes, sir; several times.

Q.—You noticed the material that was being excavated? A.—Yes, sir.

Q.—Near the bottom of the canal as it was being excavated

preparatory to lining? A.—Yes, sir; but I couldn't state the character of that material.

Q.—You stated that you were aware of the omission of the sub-channel? A.—Yes, sir.

Q.—What was the cause, if any, for the omission of that sub-channel? A.—I presume on account of the expense. It would be a very expensive construction.

Q.—Why expensive? A.—On account of the increased difficulty of construction.

Q.—Was that difficulty caused by reason of the nature of the soil encountered at that depth? A.—It would be, and also due to the character of the conformation of the bottom.

Q.—You think the omission of that sub-channel was a desirable change, under the conditions existing? A.—As far as economy is concerned, yes, sir. It would also be a desirable change if the same results could be obtained without the sub-channel as with it.

Q.—You remember enough about the character of the soil encountered at that depth, to state whether you considered it was practicable or impracticable to construct it according to the plans prepared? A.—No, sir.

Q.—The Toulouse canal I understand you to say, was moved a distance away? A.—Yes, sir; some distance away from Canal Carondelet.

Q.—Was it decreased in sectional area from what it was planned? A.—I have no knowledge.

Q.—The simple fact of moving it, wouldn't alter it's efficiency? A.—No, sir.

Q.—Nor would the substitution of a concrete slab for a brick arch, affect the efficiency of the canal for the purposes for which it was designed? A.—It would not.

Mr. Carson—I would ask the same question that I have asked all of the witnesses who have preceded Mr. Bell. Do you know of any defects in the system; any structural defects; bad places in the work; bad breaks in the concrete or masonry, or anything else that you would regard as a structural defect? The reason I ask is, that we want to see such defects if they exist. A.—No, sir; I have no knowledge of any such defects.

Major Harrod—I would like to say something about that Tou-

louse canal matter, for somewhat personal reasons. I have been held absolutely responsible for that location, and blamed for it, not by the Drainage Commission, but by others, and I would like you to know it—I don't care who else does—that that location was made by the Advisory Board in these terms: "The drainage of the two sections is collected into two drainage canals tributary to the main canal, between the two navigation canals, which is served by pumping station No. 2, located immediately above the Carondelet navigation canal. Of these two drainages, one is on St. Louis street, on the river side of Broad street, while the other occupies the location of the present Toulouse canal." That is the location by the Advisory Board. Drains the area on the lake side of Broad street, and has the same form and direction as the Villere street canal above mentioned. Page 27, the last paragraph in the report of the drainage of the City of New Orleans, 1895. That location was a part of the original plan. I knew it was a weak location, as everybody did. Major Richardson stated at the time, and there was some discussion about it, but nevertheless it was made by the Advisory Board, but I did not change it until the contractors came to me with an official notification that they considered it dangerous. I immediately took it up and asked the Drainage Commission to give me assistance in the way of advice, and Major Richardson was called in. I then requested a meeting of engineers and contractors, which was held, and the location promptly changed, so I have never been able to see my responsibility for the location, although I have been held responsible.

Mr. Benzenberg—If I understand you correctly, you were held responsible for the original location or for the changed location? A.—Not for the original location. It was the error of the late Mr. Coleman in selecting that location, and I was held responsible for putting the canal in a location from which it had subsequently to be removed.

Q.—Where did the other advisory engineers come in? A.—I let them in, willingly.

Q.—Was any part of that Toulouse canal constructed according to the original location? A.—No, sir. After leaving pumping station No. 2, we made that reverse curve in the masonry that you saw down there.

Q.—And that was made immediately on the starting of the work? A.—That was made to connect the discharging part of the pumping station with the new location of the Toulouse canal.

Q.—What I wanted to ascertain, was whether any work was done on the original location? A.—No, sir.

Q.—Then nobody suffered by the location as originally recommended? A.—I think not. The change cost no more when it was made, than it would have cost at any previous time.

The Chair—Having been a member of the original Advisory Board, I would like to say that we had such a large work before us that it was neither possible, nor was it necessary, at that time, to establish, finally, all of the details of this work, and I, for one, want to say that I never would have objected to a change such as that of the Toulouse canal. In fact, we designated the general location for such a canal. Whether it was put in the exact old ditch, or alongside of it, or a hundred feet away from it, was, so far as I was concerned, entirely immaterial, and that is why I consider there was no change whatever.

PROCEEDINGS OF THE MEETING OF THE BOARD OF ENQUIRY, HELD IN THE CITY OF NEW ORLEANS ON THIS, THE 18TH DAY OF MARCH, 1902.

Members of the Board—Messrs. Hering (Chairman, Carson and Benzenberg.

WITNESSES.

Richardson, H. B. ..... Page 2
Kirkland, W. C. ..... " 9
Earl, George G. ..... " 21
Creighton, W. H. P. ..... " 29

TUESDAY, MARCH 18, 1902.

The Board convened at 9 o'clock a. m.

Present: Mr. Hering, Chairman, and Messrs. Carson and Benzenberg.

L. W. Brown, the City Engineer, and perhaps entirely, it may be said, with the advice, assistance and criticism of the consulting engineers. I cannot recall, and I suppose it is not expected that I should recall, a great mass of details in those specifications as prepared, and I cannot say, from my own knowledge, whether or not those specifications had been complied with. It would be beyond my knowledge to know that. Some matters have come to my attention quite lately, the matter of cement, for instance, which I suppose is one of the matters into which you are specially enquiring, although that formed no part of the original plan for the drainage of the city. In the matter of cement, I presume if any one had asked me, three or four weeks ago, whether imported Portland cement was required in those specifications, I probably would have answered that I didn't think it was. I might have answered that way, but, at any rate, I do not know. At all events, I have seen since that time, that certain portions of that work required imported Portland cement, and a term of that kind, although I am not a cement expert, or profess to be, I am sure, if I was preparing specifications, I would not think of using. I suppose that is the reason I say that if one asked me, two weeks ago, I would have said I did not think that was in there, but I now understand that it was; that some time after the contracts were made, when Major Harrod became the Chief Engineer of the Drainage Commission and the execution of the work was undertaken—I couldn't recall the exact time—I certainly was familiar with the different kinds of cement made, and understood slag was to be used instead of the imported Portland cement, but that the specifications for the cement to be used, were drawn much more rigidly in the original specifications, which I considered, although I approved them, as loose specifications. I think the fineness of the cement was certainly inadequate, and my own impression is, from what I have known of cement, that this requirement as to weight was an objectionable one, because you cannot have a very fine cement and have it as dense as it would be if it was somewhat coarser. The test as to its strength was not the best in the original specifications, but the new specifications called for a very much finer cement and required new tests, chemical and otherwise, as of course you gentlemen have

before you, and I was merely going to say that at that time I had certainly supposed that Major Harrod, the Chief Engineer of the drainage work, was doing a desirable thing in permitting that cement to be used, because I believe it to be a better cement. I don't recall that I ever heard or thought, at that time, about the cost of it. I was frequently with Major Harrod, saw him very often; in fact, was his next door neighbor, and while I often heard him talk of that cement at that time, not to me alone, but in company with other engineers and at various places, no other idea ever entered my mind than that he was getting a better kind of cement than that which was originally specified, nor have I any doubt about it, with deference to what you gentlemen may know about it. I don't think I need say any more on that subject.

About departures from the original plan, Major Harrod has just mentioned to you one that he spoke of as a departure, if I understand him, and that was the location of the Toulouse canal. I am not able exactly to understand that the Toulouse canal as now built, is really a departure from the original plan. I certainly have the impression, without having gone back to that report at all, lately, to refresh my mind; I certainly have the impression that when this matter was under discussion by the Engineering Committee of the Advisory Board, it was thought that a beginning might be made in this second section and that pumping station No. 2 might be built before No. 7 was built, in which case its operation might be carried on by a meeting of the Toulouse canal and the next below that, a high level canal. If I am wrong about that, I trust Mr. Hering will correct me; and in consequence of that idea that it should be, temporarily at least, a high level canal, it was certainly proper to talk about expropriating property because the street was not sufficiently wide for canal purposes, and I must say that I had a general idea that that was to be done, and that when that was moved, as would be required to give an embankment on that side, and station No. 7 came to be built, so that the Toulouse canal and the canal between stations 2 and 7 was finally completed and No. 7 built, and this canal, becoming a low level canal, there would be plenty of space, for the earth taken out would have been there in the canal, and, in a general way, I would have supposed the location of that canal would have been

about just where it is now. That was in my mind when these plans were originally prepared. I am aware that it was proposed, but it seems to me that was part of the original plan; I think I am aware it was proposed under the contracts that were made, to locate that canal right along in its old position, which, in my judgment, was much too near the canal which stands at tide level, to make it safe, and it was in that matter that I was called in consultation by Major Harrod, as I remember. Perhaps it was the Board of Commissioners. I remember that I wrote a letter, after looking it over, in which I said that, in my judgment, the canal ought to be moved over some 80 feet, and I believe that was done. If that was a departure from the original plan, in my judgment it was a very wise and essential departure and one that added to its safety and efficiency.

You spoke of another, Major Harrod, to these gentlemen, in which I was called in, about the St. Louis canal. I must say that the details of that change do not recur to me now, but I will ask if it was about the putting of piles under the walls. Was that the time?

Major Harrod—It involved the construction of the canal on piles and it involved the narrowing of the canal.

Major Richardson—One reason that I do not remember it, is that I have been quite a number of times, entirely unofficially, to look at the works, and therefore I haven't quite remembered what particular point I was called in consultation about. I remember distinctly when we were there, and at that time that it was understood, certainly with my concurrence and advice, that, the St. Louis canal having shown signs of its walls falling in—and perhaps they had done so already, when that was brought up—that it was agreed and understood it would be wise to omit the sub-channel, but I am unable to say, myself, if that is the change that is meant. The omission of the sub-channel in any of these conduits, I am certainly unable to say that that is detrimental in any way to the efficiency of the system. I believe there is a paragraph in that report which forms a part of the plan of drainage, which you probably have looked at since I have, which says that it is desirable that those sub-channels should be made in all conduits above a certain cross section of area, and I agreed to that at the

time, but subsequent thought about it had led me to think that any advantages to be gained by that, by carrying the low water, would be more than neutralized by the fact which I suppose is an undoubted fact, that when it was full its hydraulic radius certainly would be less than otherwise. It would expose a greater surface to the current, and therefore, of course, other things being equal, it would not carry as large a volume of water. And in addition to that, it seemed to me evident, as I saw the work going on, that that would be a costly construction; costly to the Drainage Commission and to the City of New Orleans; not simply to the contractor, and for that reason I thought it really desirable that that form of structure should be changed to a simpler form, such I believe, as has been done.

Now if there are other changes that have been made—this map shows a drainage station to be placed out here, No. 8, we called it. My recollection about that, is that before anything was undertaken, that the same engineers, the same parties, we thought that that could be omitted as a part of the original plan. I really don't recall anything else, but if some one should ask me, I might know something that I have not referred to. I don't know how well I have covered the matters asked about, and yet from my general interest in it, I frequently went and looked at the work. There is one thing I would like to say about the cement, which I did not. While I have not been inside of these conduits at any time, except on St. Louis street, I certainly have seen them while they were open. I have seen the sort of masonry being put there, and I have never seen any places or any part of the cement that struck me as being in any way inferior, in strength or quality. I have seen some pieces of brick taken out that clearly showed the good character of the work.

The Chair—Tell us your opinion as to the reduction of the size of the St. Louis canal. You remember that it was reduced about 3 feet in width? A.—I do recall that. There was a reduction, but I don't distinctly recall what reduction was made. My recollection of that has been that they rested upon computations that were made under assumed conditions of rainfall and different classifications; I think they are called Zones in that report, and that the conclusion was that if that canal failed to carry as much

... was originally designed, and I don't ... determined that it would be so, ... it was unwise to go to the greater ... originally intended. That it would ... drainage in from some other point; I ... of the canal. My recollection is not ... that is my impression.

... making the reduction in width was ... ; due to the ground, as I remem- ... undoubtedly that was the reason, and ... that I am aware of.

... recollect distinctly that you concurred in ... before it was made? A.—I certainly ...

... of the work where the Advisory Board ... a Board of consulting engineers, your ... carried in unanimously, I suppose? A.— ... is no record to the contrary. I have ... it, at all.

... think that any of the departures that ... plans have been in any way injurious ... not to be as perfect as it was originally ... not aware of any departure that has ... way. On the contrary, such as I know ... been wise and proper and tend to the ... system. Q.—you are aware, of course, ... out; that the main canal is not yet ... and do you expect the system to be in ... this main canal being finished? A.— ... contemplated in that report that that ... section after another, and that the con- ... might come as the last thing.

... you think that this system would work ... construction of this main canal? A.— ... satisfactorily so far as the discharge of the ... area of the place is concerned, but I ... be satisfactory to the people generally, ... water is carried away further from the

city, into Lake Borgne, as was originally designed, and I have never heard any intimation from any one that anything else was contemplated than to carry out that idea.

Q.—Until that canal is built, all of the water, including the foul, ordinary flow, must necessarily go out into Lake Ponchartrain? A.—Yes, sir.

Q.—And this water cannot be prevented from going into this Lake Ponchartrain without the building of the main canal? A.—I know of no way it can be done.

Q.—Do you think that the change in the locations of pumping stations 1, 3 and 6, have been injurious in any way? A.—I do not. I never regarded that as any departure from the general plan; never occurred to me so.

Mr. Benzenberg—Have, in your opinion, any of the departures which have been made in the construction of the drainage system, affected the general efficiency of the same? A.—I know of no departures that have so affected it.

Q.—And if finally carried out to completion as originally contemplated, will do all that the Advisory Board of Engineers expected to realize? A.—I have seen nothing to make me doubt that.

Q.—Is it possible, or not, Major, in drawing up a general plan of a system with general specifications, to make such plans and specifications so complete in detail that they can be carried along afterwards in doing the work, without some minor changes to meet local conditions? A.—I think not, in any work of any such extent or magnitude as this proposed drainage.

Q.—There will always be some features of the entire system which can be improved upon by a closer study of local conditions, I assume? A.—I think so, certainly.

Q.—Which will tend to benefit rather than deteriorate the efficiency of the system when completed? A.—Yes, sir. To assume otherwise, would be to suppose that people never could learn anything.

Q.—The order that was outlined by the original Board—Advisory Board of Engineers, in which this work should proceed, was fixed with a view to accommodate the largest number of people

and the most densely populated territory, I suppose? A.—I think it is so stated in the report. That is my recollection.

Q.—In view of your information and knowledge on the subject at the present time, would you still adhere to recommending that order of construction as then outlined? A.—I think so. Yes, sir, I can say I would.

Q.—And knowing what you do, and from the conditions existing at present, you would still adhere to recommending the departures that have been made, in which you concurred at the time? A.—Yes, sir, with my present knowledge.

Q.—There is nothing that has occurred that would induce you to change your opinion upon any of those departures? A.—Nothing that has occurred that has come to my knowledge.

TESTIMONY OF MR. W. C. KIRKLAND.

The Chair—Mr. Kirkland, you have been assistant engineer in this work for a number of years, and are now the successor of Major Harrod? A.—Yes, sir.

Q.—Can you tell us what you know concerning the departures that have been made on the plans that were originally adopted, with reference to design, and also with reference to any departures that may have been made in connection with construction, particularly in regard to cement, which has been a subject specially brought before us? A.—In the first place, with regard to the pumping stations; you wish me to explain in regard to the maps?

Q.—You have heard the testimony of Major Richardson? A.—Yes, sir.

Q.—And if you have anything else to say, that he has not brought before us, if you will kindly dwell a little more on those than on those matters that have been mentioned, that is about what we desire. A.—With regard to the pumping stations. Pumping station No. 6, shown on the plan, has been moved a short distance towards the lake. Pumping station No. 1, was moved from the New Basin canal to Melpomene street, its present location.

Q.—If you agree with the changes as shown on this plan, exhibit C, and which were mentioned by Major Richardson, it will save considerable time and obviate the necessity of going fully

into the details. Does exhibit C correctly show the changes of the stations and the general lines of canal. Please examine all the changes that are indicated on exhibit C, and state whether you have anything to offer in criticism thereof, and do the changes thereon indicated, meet with your approval? A.—Yes, sir; the plan shows distinctly, the changes that have been made.

Q.—By whom was that plan made; under your direction; the plan showing the changes? A.—No, it was not made under my direction. One point I would call attention to, I think, where it differs from the original plan in one feature, and that is that pumping station is now designed to discharge into Lake Pontchartrain, and I believe the plan that was substituted for this plan shown here now, contemplated discharging toward Lake Borgne.

Mr. Benzenberg—Exhibit marked D, shows that, does it? A.—Yes, sir. That is the only difference from the plan that was adopted under the general specifications of 1895. Those specifications contemplated, as shown on that plan, discharging all into Lake Borgne, and that is the only difference in the pumping stations with the exception of minor changes in the lift of the pumps.

Q.—Ultimately, station No. 3, by the completion of the main canal, can discharge into such main canal and into Lake Borgne? A.—Yes, sir.

The Chair—Do you approve now, of this change of station No. 3? A.—Yes, sir.

Q.—You approve of all the changes as shown by the red marks on exhibit C? A.—Yes, sir.

Q.—Now exhibit D shows the progress of the work. The double red lines show, do they not, the drains that have been completed, the single red lines, those under construction, and the dotted lines, those advertised, do they not? Yes, sir; that represents distinctly what has been completed, what is under construction and what is contemplated at present.

Now with regard to changes from the original plans, so far as the construction of the canals is concerned, the only changes that I know of that could be called a departure from the original plan, is the narrowing of the St. Louis street canal and the omitting of the sub-channel in that canal. The changes that have been

grade, were absolutely necessary. As to the originally placed on the canals, they were not would have been. For instance, I will call your two sections which were more carefully sections it was not contemplated to build were made up, and this is a grade in two sections. You will notice that the flood slope in this greater bottom. It became absolutely necessary grade. Those were changes which were made to the construction when started.

The profile you refer to, was on what is A. Yes, sir; and the profile of Julia street.

You do not mean to say that this change of grade the original plan, do you? A.—Sheet 13, of the original plan. I mention this case to show change that was made, that in the grades, was necessary to enable the canals to be constructed. This constructed with a cover, if the flood slope was as shown on the plan. The changes in the canals, when the width of the majority of the as given by those specifications, was taken into considered fully, and in more or less frequent de- as to the width and sizes of the present very closely to what was originally intended. customary practical slope was in all cases

the limit of the natural grade of the streets elevations at the pumping stations were practically the same as the original plan.

of each system there was only enough A. Yes, sir; and to secure a road- original grades I will say, a great many the canals with the view of constructing some of them; quite a number of them, and they were too high to construct a would have admitted of water stand-

Mr. Carson—Were all the changes that were made, so far as you know, the result of additional study and additional information to that possessed by those who made the preliminary plans, or original plans? A.—Yes, sir.

Q.—And you regard all the changes that have been made, as improvements? A.—Yes, sir. The only change that I believe could be questioned at all, was the omission of the sub-channel in St. Louis street, and, in my opinion, it is impracticable to construct that in the soil of this city, to obtain a good and suitable structure afterwards, and that omission was, to a great extent, overcome by the substitution of the two flushing pumps into the canal from the old and new basin, which enabled them to attain the same obect as a sub-channel. I understand there is a flushing pipe at the head of St. Louis street, and another at the head of the basin.

Mr. Benzenberk—A flushing pipe in connection with the navigation canal? A.—Yes, sir.

Q.—So that any deposit there in the main channel during dry weather, could be washed down towards the pumping station? A.—Yes, sir; the capacity of the flushing pipe at St. Louis street is sufficient to create a velocity below the walls of the canal, in the sub-channel, as it were, of the present canal, of three feet per second, and that would wash any material out.

Mr. Carson—You thought that the sub-channel was an impracticable piece of engineering, under the circumstances that existed there; that is, if it had been put in you would have had an unstable structure, or one of doubtful stability? A.—Yes, sir; that is, if a reasonable or economical and practicable amount of money had been expended in putting it in. Of course, if built out of solid stone, it would stand, but it wasn't practicable to construct it in this soil, in line canals emptying, as the original plan shows, into mud canals in the upper district. It would also, I believe, be almost of no value, because it is impossible, without lining those canals, to construct an earthen canal in this city to that depth; in fact it is almost impossible to construct an earthen canal below an elevation of eight feet, and most of the sub-channels, if they had been put in, would go below that elevation.

Q.—What do you mean by eight? A.—Eight feet above Cairo

datum. As you know, the maximum elevation of any of the flood slopes, was considered to be 15, so the Board decided, and I think it was a proper decision, for it was impracticable to dig canals to a depth below five, even when lined with masonry.

Q.—Are you familiar with all the work that has been constructed here? A.—Yes, sir.

Q.—Do you know of any defects that exist in it; that is, in the construction. Do you know any places where the masonry is out of shape, out of line, bulging, or faulty construction of that kind? A.—No, sir; and I may say I have made an inspection of all the drains and canals.

Q.—If there are any bad places, we want to see them, and that is the reason I asked. We want to get hold of thedefects more than the good points. A.—There are no places that I know of, that are defective, and if they were bulged out of line, why they have been repaired.

Q.—I mean existing now? A.—No, sir.

Mr. Benzenberg—It is generally conceded that the omission of the sub-channel, so-called, was made necessary because of the nature of the soil in which it was to be constructed? A.—Yes, sir.

Q.—And if that character of soil had been known beforehand, the construction of the sub-channel would not have been advocated or planned? A.—Well, I can't say as to that.

Q.—In your opinion? A.—My opinion is that they couldn't have contemplated a design of that character if they had known the nature of the soil on which the foundations rested.

Q.—You have been connected with the commission ever since the work under the changed plans, was begun? A.—Yes, sir.

Q.—Do you know of your own personal knowledge, that it was ever contemplated that the discharge of dry weather flow and ordinary rainfall into Lake Borgne, was to be abandoned? A.—It has always been understood it would be abandoned when the Broad street canal was completed.

Q.—What I mean to learn from you, is whether it was ever thought that the Broad street canal, during the dry weather flow and ordinary rainfalls, was to be abandoned; whether that feature of the first plan was to be abandoned? A.—No, sir.

Q.—Is it, or has it been in your mind to abandon that feature of it since you have become Chief Engineer? A.—No, sir.

Q.—As Chief Engineer, you propose to still carry out the entire scheme of the Advisory Board of Engineers as submitted by them, as soon as funds are available? A.—Yes, sir.

Q.—You have never known that it was ever contemplated on the part of the Drainage Commission, that the Broad street canal was to be abandoned? A.—No, sir.

Q.—But that the discharge of the dry weather flow and of the rainfall, into Lake Pontchartrain, was simply a temporary expedient? A.—Yes, sir.

Mr. Carson—Have you seen any evidence, after storms or otherwise, that this change in the size of the St. Louis canal was an error? Has there been any physical evidence of any kind, following great storms, that made it appear to your mind that they had gotten the size of the St. Louis canal wrong, and that it ought to have been bigger? A.—No, sir; there has never been, I should say, a good opportunity to observe that, as the pumping station No. 2 has never been capable of carrying off the water that the canal would discharge. They are not at present in operation.

Q.—Do you know about the condition of the screen on the suction side of the No. 2 pump at the time of the storm of last Friday? A.—Yes, sir.

Q.—What was the condition of that screen? A.—It served as a dam for the water.

Q.—What made it so serve, and how did that happen? A.—The smaller stuff clogged into the dam. The screen, of course, could be removed whenever the canals were all completed and in proper working order. It could be then removed entirely.

Q.—How much of a dam did that make; that is, how much higher did the water stand on the up-hill side of the screen, than it would have stood if the screen had been entirely free and not clogged up. Have you any idea? A.—Fully four feet, the difference would be, if it was as reported. I didn't see the condition, myself.

Mr. Venable—In view of the statement just made to Mr.

Carson, considering any overflow that may have occurred along this tributary to pumping station No. 2, as caused more by the screen, which withheld a head of four feet, or as caused by the pumps not being in operation, which were originally designed for a head of three feet—this question is intended to apply only to the present instance, and not to have any bearing upon the condition of pumping station No. 2, itself, and is made because it is quite possible that such an obstruction as is caused by the screen, may have been causing similar trouble in the past, which has been ascribed to the condition of the station to a greater extent than is actually the case.

Mr. Kirkland—I simply asserted, when asked the question if the diminution in the width of the St. Louis street canal had been evidenced by the flooding of the streets in that locality, that a good opportunity had not been afforded to observe that, as the pumps at No. 2 had never been capable of carrying the discharge of the canal. In this particular instance, the flooding was caused by the screens in the canal and not by the inability of the pumps, but it does not follow that the pumps would have been capable of carrying off the water, had it not been dammed up by the screens. I asserted that the conditions favorable for an inspection, had never occurred.

Mr. Venable—I would like to state, as a matter of fact, that the pumps are not now in a condition to perform the duty of the station, as the changes to produce the higher lift are now progress. I merely asked the question in order that there might not be a misapprehension in regard to the conditions produced in the city by the incompleteness of pumping station No. 2, for this head which has just been spoken of, would evidently exist, and evidently has existed in time of storm, whenever the pumps were in operation, as well as on the recent occasion, and if there is a cause there which brings a head of four feet, which is not contemplated in the system, the pumps at No. 2, which were originally expected to lift a head of three feet, cannot be expected to entirely relieve the situation, and many of the overflows that have been ascribed by citizens to the pumps themselves, have doubtless been caused, in part, and, apparently, in a very large part, by the condition of the screens. This is the first time that this mat-

ter has ever been brought to my attention. Pumping station No. 2 has never been entirely completed and offered for test, although the drainage of the city has been passing through it for several years, there being no other path for the drainage to pursue, and during a part of that time I think that this cause that has just been mentioned, has been very readily remedied, so that some method of pumping must be found immediately, or before this pumping station No. 2 can undergo this test. The station is, at the present time, in the hands of the Drainage Commission for drainage purposes, to the extent of its capacity. When the new motors and pumps are installed, it will pass into the hands of the National Contracting Company for a fifty day test. That is the actual condition. If the screens can be removed or altered, that head can be removed from the station.

Mr. Kirkland—It is not a continual head. My understanding is that that screen was put in the canal at the instigation of the pump men, and it will be taken out and removed just as soon as we have the pumps under our own control. The screen was put in at the instigation of the pump men, as they said they would not be responsible for any breakage caused by timber or anything passing through the canal. We put the screen in, and it has been found that it obstructs the flow of water.

Major Harrod—I made the same statement, yesterday, that Mr. Kirkland has to-day. I did not intend to raise the question of the responsibility of the contractorfor the overflow that occurred last Friday.

Mr. Venable—I did not consider that that question was raised, but this information has just come to my notice, the station not being in the hands of the Contracting Company at the present time, and that brought forth my enquiry. I don't know that it bears upon the matter, but the condition was a surprise to me, and I think the point I mentioned should be on the record if the matter of the head against the screen is regarded at all. If that is done, I think the remarks I have made should be regarded, also.

Mr. Benzenberg—The screen was not a feature of the original plan, or scheme, was it? That was put in later? A.—It was put in, I believe I am correct in stating, it was put in on account

of the pump people, the Allis people, making a demand on the Drainage Commission for a screen as the pumps were liable to be broken before they could hand them over to the Commission. Isn't that the fact, Major Harrod?

Major Harrod—Yes, sir.

Mr. Benzenberg—Was any timber or large pieces of floating material intercepted by that screen? A.—Yes, sir.

Q.—From what source did that timber arise? Where did it come from? A.—From the contractor leaving it in the canal; a portion of it. It might not have all been so, but it was the action of the contractor, some times. There were openings in the canal in several places, and boards and other things would naturally get in, but in that case the contractor allowed pieces of timber to be in the canal.

Q.—Those conditions still exist, together with liability of timber getting into the canal? A.—No liability at present, no, sir; not of any large sized timber getting in.

Q.—The pumps which are intended to lift the storm water, are what are known as screw pumps, are they not? A.—Yes, sir.

Q.—Consisting of a series of thin blades cast on a hub? A.—Well now, I think they are bolted to the hub.

Q.—They consist of thin, cast iron blades, and the space between them would not permit the passage of any timber? A.—All the timber that went in that direction.

Q.—It would have to be short pieces of timber, wouldn't it? A.—Yes, sir.

Q.—Now this timber would naturally cause the breakage of these blades? A.—If they had caught the timber.

Mr. Venable—Did not such a breakage of blades actually happen at pumping station No. 6, where other pumps were installed? A.—I am not positive; I think there was a breakage of some kind, though I don't know whether it was due to that cause, or not.

Q.—And every pumping station in which a vast variety of floating material is to be found? A.—Yes, sir; and there are also large screens which will have to remain.

Q.—There are screens at 6 and 7, which will have to remain there for that purpose? A.—Yes, sir.

Q.—It was possible, also, during the period No. 2 was in opera-

tion, and when the screen was placed there, that other parties, and not the contractors, for instance, children, could have placed timber or other floating material in that canal which would afterwards reach the stations? A.—Yes, sir.

Mr. Carson—You haven't touched on the cement question, yet. Did you help to prepare the new specifications at the time the steel cement was first used? A.—No, sir.

Q.—You have seen the masonry that has been laid with the steel cement and that laid with the Portland cement? A.—Yes, sir.

Q.—The imported Portland cement? A.—Yes, sir.

Q.—What difference in quality after the construction of masonry with these two kinds of cement, have you noticed? A.—You mean steel Portland?

Q.—Steel Portland and imported Portland? A.—Well, my observation has been that the steel Portland cement that is slower setting than the imported, and it is susceptible of being worked in a manner that the masons can shave down a joint with it very full and compact, whereas the imported cement that was used, has a fast set, and it is very difficult to get the masons to keep the mortar tempered in such a manner that they will shove a joint as full as with steel cement. In other words, steel cement works much more like the ordinary plaster, lime and mortar that you use on a wall, and in that way I observed that all the masonry done with steel cement, with the same amount ofsu pervision and the same degree of watchfullness from the masons, was of a firmer quality as regards fullness of the joint, and my observation was that the cement was first class in every respect, whenever I tested it; whenever I tore up the masonry.

Q.—That is, that where you have torn up masonry, you found that which was made with steel cement, apparently as good as that made with the imported Portland? A.—Yes, sir. The joints, in fact, were also, from my observation, better shoved and fuller. It is impossible, of course, to always get a mason to shove the joints full and compact.

Q.—You are speaking about brick work. How about the concrete? A.—I don't know of any particular difference, so far as the concrete is concerned. It was good concrete. All the con-

crete I have taken up, of Portland and steel cement, has been good. One was as good as the other, as far as ordinary inspection would show.

Major Harrod—I would like Mr. Kirkland to say something about the character of the inspection; whether there were a considerable number of inspectors, and whether they were capable and trustworthy.

Mr. Kirkland—The work, since its inception, has always been looked after, each canal, each, as a rule, by a rodman and inspector of brick work in most cases, and an inspector of concrete, and in finishing, the inspector of concrete generally looked at it.

Mr. Carson—How were these inspectors selected. Were they selected on account of their experience and judgment, or on account of any feeling of favoritism on the part of anybody? A.—The first inspectors who were selected, were selected by an examination; a civil service examination; or one similar to that, held by the Drainage Board, and subsequent to that, inspectors were appointed after they had been on the work as rodmen for a year or so; some more and some less, and had had experience in that character of work.

Q.—The end in view in selecting them, was to get good men, and nothing else? A.—Yes, sir. All the inspectors who have ever been employed, have been men who had experience, were good, honest, conscientious men and understood their business.

Mr. Benzenberg—The inspectors in charge of the brick work, the concrete work and finishing, were continuously on the work? A.—Yes, sir.

Q.—And during all such work? A.—Yes, sir.

Q.—They were not there simply for a short time and then went somewhere else, but they were on there continuously whilst such work was in progress. A.—Yes, sir.

Major Harrod—There is no truth in the statement that was made here yesterday, that the supplemental or additional specifications for the cement were prepared anywhere except in my offic. I want to contradict that.

In regard to the matter of changes and departures from the plans, and the way they occurred, and so on, I want to call attention, first, to Act No. 114, of 1896, which you gentlemen have

here, section 4 of which says: "That said Commission shall have full power to control and execute the drainage of the City of New Orleans, and may proceed to execute and carry out substantially the plan for such drainage, adopted by the Council of said city, by Ordinance No. 10,091, Council Series, approved July 10th, 1895, so far as it may find said plan desirable and practicable, with the right, however, to modify the same as in its judgment circumstances may require."

Specification C, page 8, paragraph 15, says: "Should the engineer in charge, deem any changes necessary in the extent, location, grades, lines, dimensions or quantity of work required, such changes shall be made by the contractor at the same rate of compensation as hereinafter stipulated."

TESTIMONY OF GEORGE G. EARL.

The Chair—Mr. Earl, Major Harrod has mentioned your name to us as being one who has some knowledge of this work. Will you kindly state your connection with it, and also what you have to say regarding any departures that may have been made from the plans and from the specifications? A.—I have never, but once for a short time, had any connection with the drainage work, and that was in the repair of the cave at St. Louis street, which work I was designated to supervise, representing both the National Constructing Company and the Drainage Commission, having been, myself, inside of the work there. The work was being done, under the contract, as extra work, at, of course, plus a percentage, and it was put in my hands.

Q.—What was the nature of this cave? A.—It was a short section of wall which had moved in and down at the bottom, letting the "I" beams down, as I remember, about two feet, and disrupting the bottom.

Q.—This was on the St. Louis canal? A.—Yes, sir.

Mr. Benzenberg—Whereabouts? A.—At about Tonti street.

Q.—How far is that from pumping station No. 2? A.—About six or seven blocks, I should say.

Q.—Go on. A.—Do you wish me to describe the repair work done there, or speak as to the concrete, or give a history of it?

Q.—Give us what you know, first, if you know anything, regarding departures from the specifications, and if you haven't anything to say as to that, about your own experience in the construction of this work? A.—Do you desire that I should start, first, on the basis of departures as to plans and specifications?

Q.—If you can add anything to what is before us already? A.—I don't think I can add anything at all, so far as that is concerned.

Q.—Did you hear what was said? A.—I heard Mr. Kirkland and part of Major Richardson's testimony, only.

Q.—Can you confirm what you heard them say, or is there anything you cannot confirm? A.—Yes, sir; so far as my knowledge goes, everything that they said is correct. You will understand that I have not had much connection with the work, and therefore not a very particular knowledge of it; not that knowledge that they have, but my impression is that there has not been a general change that was mentioned as a departure from the plan, which was not wise and looked towards economy in the interest of the city.

Q.—Now with reference to the construction of the work. You superintended some repairs you said. Can you tell us about that? Can you throw some light on the subject as to which we are making enquiry? A.—As to its construction, I found all of the work in thoroughly good condition, both in the concrete and in the masonry. There was used steel cement in the upper section of those walls that we had to tear into a little; that is, they used steel cement in the arches, and concrete in the bottom, and we had to cut into some of that, and so far as thecement was concerned and the setting of the concrete, it appeared to have given thoroughly good service. It was as hard as anything I ever saw.

Q.—Had the caving in that you speak of, any relation to the character of the material that had been used in this work? A.—No, sir; not to my knowledge.

Q.—What caused the wave? A.—There was a track running parallel with the canal and close to the wall, and the wall rested there on a plank foundation, with a soft sub-stratum underneath, and I have always believed that the vibrations caused by passing trains caused that wall to settle, and that settlement forced out

the supports of the masonry, letting the wall down and in, in the condition in which it was.

Q.—The masonry where? A.—Under the wall.

Q.—And in the canal? A.—Yes, sir.

Mr. Benzenberg—Did the work slip at the same time it fell? A.—Yes. sir; it went down and in, both, about two feet.

Q.—The cause was therefore due to the insufficiency of the supports of the walls and foundations? A.—And insufficient strength of the thin layer of concrete in the bottom, which broke through.

Q.—Raised up? A.—Yes, sir. Had the resistance between the walls, at the bottom, been strong enough to hold so that they could not have come together, I don't think the cave could have occurred.

Mr. Venable—Was the construction modified after that? A.—Below that point they had driven piles, but whether the driving of those piles was subsequent to the occurrence of the cave, or not, I do not know.

Q.—I was speaking of the part you restored? A.—In that part that was restored, of course the construction was modified. They used there, a timber bottom.

Q.—Simply to hold the two walls apart? A.—Yes, sir; substantially an inverted arch was set in there, and the canal, from that point out to station No. 2, except such portion as was on piles, was reinforced in the same way for fear that a similar accident might occur anywhere in that line.

Mr. Benzenberg—You say repaired; you don't mean there were any accidents in it? A.—No accident, no, sir. There had been some slight settlement, and, as I understood it, Major Harrod thought it would be better to guard against any similar accident by a reinforcement of the bottom.

Mr. Venable—Is it your opinion that the plans now being employed on canals of moderate width, namely the placing of cypress planks across the entire bottom of the canal instead of walls on the sides, that this planking in the bottom, not rigidly connected together, is a superior construction and likely to prevent such accidents in very bad soil? A.—I have always believed that the safest method of constructing these canals, wherever economy permitted it, was to excavate to a level foundation and to build

up from that foundation. In other words, the upper section there, is the one that I would certainly prefer.

The Chair—I would ilke to have your opinion regarding the change of the side walls. In the old plan there was a solid batter, and in this new plan there is a vertical wall with certain other corresponding changes. Have you any opinion as to the merits of those two designs? A.—The vertical wall, it seems to me, is a better form of construction.

Q.—And that is the plan which has recently been adopted for some of the canals? A.—Yes, sir; I understand that is the lower plan.

Mr. Carson—On exhibit H, which is the original style of construction, and which is the later; the upper or lower? A.—Well, the St. Louis canal, where the cave occurred, was built substantially on the lower style of construction.

Q.—And this, the upper style on exhibit H, is a lower style, is it? A.—Yes, sir; but the St. Louis canal was a very wide canal, and this is only adapted for the narrower; not for the very wide canals. They are now being built, I believe, on piles.

Mr. Benzenberg—Mr. Earl, you are fairly familiar with the nature of the soil encountered in the construction of the larger canals like the St. Louis canal? A.—Yes, sir.

Q.—You are familiar with the character of the soil encountered at the bottom of the canal? A.—Specially with my work at the cave, yes, sir.

Q.—Was it, in your opinion, practicable to construct what was called the sub-channel in connection with the St. Louis canal? A.—Not economically practicable. I think it would add very much more to the cost of the work; more than would be justified by the value of the work in operation.

Q.—In your opinion, that sub-canal was impracticable on economical lines because of the character of soil encountered at that depth? A.—Yes.

Q.—And in your opinion there were sufficient reasons for the abandonment of that sub-canal or sub-channel? A.—Yes, sir. I never believed in it, from my knowledge of the soil, even before it was abandoned. I didn't like it.

The Chair—Can you tell us anything more about the character

of the material found in those walls, or have you stated all? A.—I think I have fully covered it. I didn't find anything to object to, at all, in the character of the material used. I don't think the cave was caused, in the least, by the material used, in any way or shape. I am certain of that.

Mr. Benzenberg—Mr. Earl, has your connection with the work of the Drainage Commission been sufficiently intimate to permit you to become acquainted with any contemplated change in the scheme or system, if such was contemplated? A.—I think I know of all of the changes that have been made or contemplated.

Q.—Do you know whether it was ever contemplated that any part of the scheme as outlined by the Advisory Board of Engineers, was contemplated. That is, to your knowledge was it ever contemplated that the Broad street canal, which would discharge the dry weather and storm flow into Lake Borgne, was to be abandoned? A.—No, sir; I have never heard any mention of the ultimate abandonment of that canal. The fact is that all of the pumping stations are being built specifically with the view of the ultimate construction of that canal. The pits are being constructed to put the pumps in place to work in that direction when they complete the canal.

Q.—And the carrying out of the scheme on the present lines, as instructed is simply limited to the financial ability to construct? A.—Yes, sir.

Mr. Carson—I would like to ask if exhibit C shows the main and important changes that have taken place, as indicated by these red lines? A.—Covers all that I know of, I believe, and more, because I did not know of this on Birch street. I would like to add to that, that I would not regard a single one of those as true changes from the original plan, at all. They are merely slight variations in the canals and pumping stations that would depend entirely on the expediency of construction.

Q.—You think, then, that the original plan is being substantially carried out? A.—Yes, sir.

Q.—I would like to ask whether you know of any defective construction in any part of the work, so that we can go and see it; anything that could be seen? A.—No, sir; I neither know nor suspect of any defective construction in any of the drainage canals.

I should, perhaps, say here, that I made a report, in conjunction with Messrs. Maloche and Tutweiler, specially in reference to the pumping stations and certain matters that were afterwards covered by an arbitration committee, which report will, I presume, be put before you.

The Chair—That covers your opinion of the work in a general way? A.—Yes, sir; that was the unanimous opinion of all three of us, and we made that examination very carefully, doing what inspection we could at the time, in the canals that were already built.

Mr. Venable—I would like to ask Mr. Earl if that inspection was made with reference to certain specific differences between the Drainage Commission and the contractor at the time. That was the case, was it not? A.—Specially with that in view, and we were also asked to, in a general way, review the character of the work which had been done, and we didso.

Q.—So far as those specific differences and disputes at the time were concerned, they had little or no reference to, or bearing upon, the character of the work which is now being examined into, had they, any more than the proceedings of the same arbitration committee which met later? A.—No, I would hardly think that they would. It seems to me that that arbitration committee, in all probability, settled all those points, and that they are now dead issues.

Major Harrod—I would like to refer, for a moment, to the matter of the alleged proposed abandonment of the Broad street canal. To my certain knowledge, that idea has never been entertained by the Drainage Commission or by any of its employees. They have all regarded, and now regard, the Broad street canal that led into Lake Borgne, as an important and essential part of the canal. A charge of that sort was made at a meeting of the Progressive Union, and the Drainage Commission through its Executive Committee and engineer, made reply thereto, and there was another document which I have submitted to you, which I will ask you gentlemen to read, relative to the charge of abandoning the Broad street canal. There was also a further charge that the order of procedure of construction was changed, and that also was answered.

The Chair—(To Mr. Earl.)—From your experience as an

engineer in charge of construction, carrying out a general scheme as outlined by an original Board of Engineers, is it possible to carry out such scheme afterwards, in construction, without some minor changes or alterations or departures for the benefit of such scheme? A.—No, sir; I don't think there ever was a scheme carried out absolutely as planned. That would be to assume that those who planned it were infallible.

Q.—It is not generally contemplated that such a general scheme or plan prepared by a first Board of Engineers, would be so complete in all of its details as to meet every local condition that may exist, is it? A.—It certainly is not, and the passage that has been recently quoted here from the Act creating the Drainage Board, shows that, in that case the law did not so contemplate.

Q.—I ask with reference to your general experience and knowledge of such matters? A.—Yes, sir. It is impossible to prepare, in advance, plans that will cover the experience and knowledge gained during actual construction of work which, if carried out under original plans, would be at the sacrifice of economy and the subsequent advantages to be gained by listening to discussions together with the experience you are constantly gathering in your work.

The Chair—Isn't that particularly true with work of such a complicated nature as this? A.—It is especially true in soil and conditions as existing in New Orleans.

Q.—It would be less true in the case of a bridge superstructure, something that can be determined with much greater exactness beforehand, than a work which is mainly dependent upon what you have under ground? A.—Yes, sir; much less. It is particularly true of any underground structure where the soil conditions are not absolutely known in advance through similar prior constructions.

Mr. Venable—Would not the same remark apply to the construction of a pumping station or pump house for service, practically new, as was the case where such structures have been erected in the City of New Orleans, that changes in location, machinery and arrangement, as well as in the actual structure itself, would necessarily have to be made from the original designs and

plans submitted? A.—I should certainly expect some changes to be required from any possible pre-considered design.

Major Harrod—These six stations that were built, have all the pumps submerged. I thought it was surely the theoretical place for a pump, to put it under the water. In subsequent stations, I concluded, as those foundations cost about $50,000 and took six months to build, that it wasn't worth the difference, and the pumps in the new stations are not submerged. They have suction pipes and are put on the floor of the station. In addition to the cost of submerging the pumps, the operation was a very hazardous one.

Mr. Carson—In the cases of those pumps in which there is a suction pipe, do you have any difficulty in maintaining a charge in them after they have stopped pumping for a time? A.—They have not been completed yet, but there is ample provision and security in the specifications for such priming apparatus as it needs, and to replace it when it is lost. We have a great deal of experience in that line, on our tug boats on the Mississippi river, where the pumps are all on deck, above water, and we have no difficulty at all, in priming them.

Q.—But is there some appartus for pumping out the air in the suction pipe? A.—Yes, sir.

Q.—There is no foot valve in them, I suppose? A.—No, sir. The pumps in station No. 5, are on the floor.

Q.—Station No. 5 is at Jordan avenue? A.—Yes, sir.

Mr. Venable—That station has been tested in operation, and found satisfactory.

At 12:15 p. m. the Board adjourned until 2 p. m.

The Board reconvened at 2 p. m., all the members being present.

Major Harrod—When the Commission first went to work, I represented to them the absolute necessity of a close inspection of all the work, and with their consent I engaged the Pittsburg laboratory to inspect all the machinery, pump and rolled steel work throughout the North, and the Tulane University to make the test of the cement. Those tests, under the contracts of 1897 and 1899, were strictly made according to the directions in the general specifications. Professor Creighton had charge of them. When this matter came up about the use of steel Portland ce-

ment, I called him in consultation and he assisted me in the preparation of the additional and supplemental specifications under which I consented that that cement should be used. He associated with him at Tulane University, I think the Professor of Chemistry. All those tests were made according to specifications, by those gentlemen, and I was guided by the reports which they made to me. Those are the facts I wished to state, and I have asked you to invite Professor Creighton here to make any statement he choses.

TESTIMONY OF PROFESSOR W. H. P. CREIGHTON.

The Chair—You have made those tests regularly, since the beginning of the work, I understand? A.—Yes, sir.

Q.—And made them, of course, under the specifications that you drew up with the Chief Engineer? A.—Yes, sir.

Q.—Of which I believe we have a copy. A.—Major Harrod has submitted a copy to you, sir.

Q.—What, in a general way, have you to say about that cement, as to your experience in testing it. How did it come up to those specifications, and how often did it fail? Give us your general idea as to the character of the cement as it was given to you; also, how you procured the samples. What the samples showed, and so on, that we can get an idea of the whole process from the time the cement arrived here, until your report was made? A.—I think that every barrel of the cement, if tested at the factory, would have passed way beyond the specifications. We did reject some cement here, but there were local causes for that rejection. It was not due to any internal trouble with the cement at the time it was manufactured. One lot of cement, for instance, got away from them; was lost and went down to Mobile, where it was sidetracked for a number of months. The cars were broken into by tramps, to sleep in; the rain beat in and the cement was spilled all over the place, and there was a general upsetting of everything, and those samples of cement were rejected. There were other samples of cement that did not come up to the specifications, and for a long time it troubled us to know what was the cause, but we finally found out that this cement, if exposed to a damp atmosphere, takes up carbonic acid and becomes carbonated. Surface cement thus deteriorated is not good. A large number of samples

of this cement were sent up to the laboratory, and some few were rejected. Probably if these latter samples had been taken from the interior of the sacks, the requirements of the specifications would have easily been exceeded. In other words, this cement takes up carbonic acid in a damp atmosphere, and it will not do it in a dry one. We investigated this, storing the cement on the floor of the chemical laboratory, and made it take up different quantities of carbonic acid by different lengths of time of exposure, and we analyzed and tested it mechanically with approximately 2, 3, 4, 5 and nearly 6 per cent of C.2 O. With an increased percentage of C.2 O. was increased deterioration, but the cement itself, outside of that, is, in my opinion, as far as our tests go, as good a cement as could possibly be used in damp work. There is none better. Good cement briquettes will stand 150 to 175, and even 200 pounds, and at the end of two or three years will stand anywhere up to 400 pounds per square inch, tensile stress, to 430 pounds. I have broken them up to 430 pounds, say a dozen of them, three years old, made with standard sand, and there is absolutely no deterioration. Even if you make concrete with deteriorated cement, viz., cement containing carbonic acid, the deterioration is very slight, and in a large mass would not amount to much. It would take a long time to cause a perceptible amount of deterioration, because the surface would fill up with something that would stop this action. I don't think the action would go on. I don't think the cement has any particular quality that would cause such a disintegration as you would have in the case of over-burnt cement, where, in hydration, it gets cracked. If any deteriorated steel were used, you could just clean off the surface and put on fresh steel cement and all further deterioration would be ended, because you would stop all chance for that to occur. It would be much like the rusting of a steel building, which you can stop by putting a little fresh paint on the outside. So, for underground work, I consider it an ideal cement. I would certainly recommend it for any future work where it would be subjected to dampness. It is very tough, not brittle; more tough than brittle. It is strong, and meets every qualification required.

Q.—How much sulphur did you find in it? A.—The sulphur question was gone into. The change is from calcium sulphide into

hydrogen sulphide. For a long time the sulphur question was our *bete noir.* Calcium sulphide is not dangerous. It was limited to one and a half per cent, and the magnesia we limited to three per cent, which is well inside of the limits. In that matter we were particular. The samples did not have an excessive amount of either sulphur or magnesia, and, as far as we can see, from the best German authorities, we were on the safe side.

Q.—To what do you attribute the softening of the cement on the outside, after it has been exposed to dry air? A.—It loses its water of crystallization.

Mr. Carson—Do you refer to this after it was set? A.—Yes, sir. It is not a cement that I would recommend for dry work. It is like a mule that would be all right for a cart, but would not be good for a carriage. But for certain kinds of work it is an ideal cement. For sidewalks it would fail utterly, and for surface work, but if you put it underneath, in the damp ground, it makes good work.

The Chair—What can you say, in that connection, in regard to the limit as to the scale of humidity? A.—Well, if placed in a saturated atmosphere it will not lose its water of crystallization. Its surface might lose its water of crystallization, but the interior would suffer such a loss very slowly.

Q.—You don't know about what degree of humidity would be the limit? A.—No, sir; that I couldn't tell, because my experiments were those carried on in accordance with the regulations, which required that the cement was to be put in water six and twenty-seven days, and so on. So far as the specifications go, I am not required to keep briquettes over twenty-eight days, and yet I have kept some of them from the beginning. I have some made four years ago.

Q.—Have they been in water all the time? A.—Yes, sir.

Q.—Have you kept any in the air? A.—No, sir; practically I have not, because my laboratory is especially dry.

Mr. Carson—You think the proper name for this cement; this steel cement, is Portland cement? A.—Well now, we can hair split on that indefinitely. It is not, of course, a burnt cement. You see the product is not burnt and then re-ground, and that is the reason why it can pass 90 per cent on a 40,000 mesh sieve.

The Chair—And that is the distinction now made between Portland cement and slag cement, or, as it is now called, pozzulavi? A.—Yes, sir. They are burning cement now, and making it a true Portland.

Major Harrod—We are now using one of those true slag Portlands, here.

Mr. Carson—Have you a record of the tests that we could readily get hold of? Have you tabulated them in any way? A.—I have a lot which I brought with me, but I did not put down the hot and cold pat tests, as the cement always passed such tests.

Q.—Do you know what the result is as to shrinkage and cracks? Supposing you make up a mass of monolithic concrete with this cement, does it behave like the ordinary Portland cement, in the way of shrinkage and cracks? A.—You would have to ask the people on the work who made observations, as to that. My tests were only those made in the laboratory.

Q.—I didn't know whether shrinkage and cracks would be more or less liable to occur with this than with the Portland cement? A.—A large amount of the trouble that occurs with cement is caused by over-burnt cement. If you get over-burnt cement and it is not properly hydrated when it goes into the work, then you have expansion that nothing will stop.

Q.—A more common trouble with Portland cement, is shrinkage; at least that seems to be the universal opinion. A.—I have made enquiries as to how this cement has behaved on the work, and all my informants say it is almost impossible to break the brick out from it. The best way is to crush the brick with a pick.

Q.—I see these are dated in 1900; have you got any that were made at the time they first began to use it? A.—Not with me.

Q.—How far back do any of these go? A.—1898, I think. The record of cement at the works runs higher than these. They have sent me the records of their own testing, and their tests are a great deal higher than that. They run regularly at 200 pounds, say in seven days.

Q.—How do you explain that? A.—Well, its a difference in manufacturing the cement briquettes. They get their cement absolutely fresh from the mill.

Q.—You mean to say there was a deterioration? A.—No, sir; but they ram the cement a great deal harder than I do. They ram the cement with a round stick about three-quarters of an inch in diameter.

Q.—These are merely copies of your records, I suppose? A.—Yes, sir.

Q.—This doesn't show the fineness? A.—The fineness invariably went above the specifications. Pats could be boiled for several hours without causing cracking.

The Chair—How often did you make those tests? A.—They were made at different intervals.

Mr. Carson—This one to three sand means by volume or weight? A.—By weight. That is normal sand. It will go through 20 meshes to the inch, and is retained on a 30 inch sieve. I put it in Chicago, and pay nearly 3 cents a pound for it.

Q.—Then this was not tested with this sand used here? A.—No, sir.

The Chair—Did you make any tests with the sand that has been used here? A.—No, sir; none with the sand used here. The specifications do not cover that.

Mr. Carson—Have you any chemical analysis of these? A.—I have not any with me, but they have been made and checked up with those furnished by the Illinois Steel people. The principal thing, in the beginning, was to see that they kept down, in magnesia and sulphur, to the limits.

Q.—But did the chemist occasionally make a complete analysis? A.—Yes.

Q.—Well, could you ask him to send us some accompanied by a letter to identify them. A.—Yes, sir.

Q.—How long have these specimens that you exhibit, been broken? A.—I can give you the unbroken specimens if you wish. These are about three years old, broken at about 430 pounds, one to three sand. The specifications call for 175. This shows the whitening from the effects of the atmosphere.

Q.—There was some statement made that has appeared in the papers in general, that the specifications for that steel cement were made—in fact it was testified to here—that the specifications for the steel cement were made in the office of the Illinois Steel Com-

pany. Major Harrod has denied that that was the case, stating that they were made here. Can you throw any light on that question? A.—The larger portion of those specifications I wrote personally. We had a regular conference, and that whole specification was the result of a conference between Major Harrod and myself, but the larger part, outside of three of the chemical constituents, were written by me. Major Harrod and I combined, and it is the joint effort of Major Harrod and myself.

Major Harrod—To your knowledge, it was prepared in my office? A.—Yes, sir.

Mr. Carson—Then that statement that it was made in the office of the Illinois Steel Company, is an untrue statement? A.—Absolutely. For instance, you can run down through it and you can see by some of these things that we had to consult with the Illinois Steel people so as to get it to correspond with their product. I wrote originally, that the barrels should weigh 400 pounds, to correspond with the German Portland cement, because I was cognizant of the fact that barrels could be tampered with. I have rejected cement simply on seeing the barrels, because I knew that they had been tampered with. This cement is very fine, 90 per cent passing a 40,000 mesh sieve.

Q.—Did 90 per cent go through 40,000 meshes? A.—Yes, sir; and more than that. On my sieve I counted the wires, and there are 220 wires each way, to the inch. It was sent to me as a 200 mesh sieve. I have rejected a number of 50 mesh sieves, because they were not standard. It is very difficult to get a 50 mesh sieve that is absolutely standard. They don't have the required number of wires, nor wires of the right diameter. I counted these wires in several places in this sieve, and they numbered 220 each way.

Q.—You say that 90 per cent will go through? A.—Yes, sir; and on the 10,000 mesh sieve you can get pretty nearly the whole of it through. Many of these statements are in my language. Probably I wrote a number and Major Harrod suggested a number. For instance, the words "the cement must correspond with the labels on the barrels," "the composition," "weight," "maker and place of manufacture," "bills of lading must be furnished when required," etc. were written by me. The exact percentage of silicia and lime they would be willing to stick to, was agreed

to by Major Harrod and myself. I insisted on the magnesia and sulphur limits. You can't dictate that a man shall make cement exactly in accordance with your instructions, because they know more about it than you do, and all that I required was that any deleterious elements should be eliminated as much as possible, and then I specified the strength required, and fineness required and the chemical analysis. I looked at it from a reasonable engineering point of view. That the specification was written in the office of the Illinois Steel Company, is simply untrue.

Major Harrod—Do you recollect what steps those Illinois people took when we held them up in order to investigate the matter? A.—As soon as any cement was rejected, they came down here and assured us that what they wanted was to ascertain the facts, because they were ignorant of any circumstance that would cause it to fail. I feel sure they stated the truth. The atmosphere up in Chicago, is entirely different from ours. They used fresh cement for briquettes, kept them four or five years and had no trouble, and couldn't see why there should be any trouble down here. They made every effort to get at the facts. We made tests from exposed cement, the samples being taken from broken bags, or from cement lying on the floor. These would give low results, and probably from this improper method of sampling, cement was unjustly rejected.

The Chair—You got all the cement in bags? A.—Yes, sir; that being the cheapest method of transportation, and the best way, if they use the cement fresh.

Q.—How long was it from the time that this cement was furnished in Chicago, to the time that you gentlemen made the test. Have you any idea as to how many days or weeks, possibly? A.—They endeavored to have it moved pretty rapidly. I think that, as a rule, they usually took about eight or nine days to get it down here, but I couldn't say positively, as I didn't follow that up. Th at wasn't my end.

Maor Harrod—After we held them up and they sent down here, they changed their method of shipping, doing so frequently and in smaller quantities, and it was used more rapidly here. Didn't trust to storage in this atmosphere.

Mr. Carson—Professor, do you happen to have a copy of, I think, "Cummings' American Cement?" A.—Is it a recent book?

Q.—Published within a year or two years. The reason I wanted it is because it has a lot of analyses of all kinds of cement. A.—I think Professor Wilkinson may have it.

Q.—Would you be willing to see if he would send it down here and lend it to us? A.—Yes, sir.

The Chair—Did you make any analysis of the imported Portland cement? A.—No, sir; the only thing we did was to make the hot pat and cold pat test and the sand and neat cement tests.

Mr. Benzenberg—Didn't you make any tests of any Portland cement in connection with this work, at any time? A.—There was no chemical test in the specifications, except the steel.

Q.—I mean the tensile strength of the imported Portland cement? A.—Oh yes, I made the tensile test. I made all mechanical tests.

Q.—At the time that you made these steel cement tests; during that same period? A.—Sometimes we couldn't get the steel, and they bought other cement.

Q.—Imported Portland cement? A.—Yes, sir.

Q.—And you tested that, too? A.—Yes, sir.

Q.—How did the tests of the imported Portland cement compare with the tests of the steel cement? A.—Well, they are about the same.

Q.—Of what brands were these imported Portland cements? A.—Sometimes it was sent to me as a German Portland cement, and at other times it was simply marked "Portland." The cement is brought to me. The samples were sent to me.

Q.—By whom? A.—From Major Harrod's office. Mr. Shall collects the samples and sends them to me. He would write just enough to identify it; so many barrels, and what station, German cement, Portland cement, and so on, but they have used other brands of American Portland cement.

Q.—Did you test those, too? A.—Oh yes, sir; they were all tested on the same plan, outside of the chemical tests. The limitations were that all cement must not set in less than half an hour, and must stand the hot and cold pat test, and that the strength

must come up to that of the steel Portland in any neat and sand test.

Q.—Did you make any test of American natural cement in connection with this work? A.—Yes, sir; Utica cement.

Q.—In the same manner, 7 and 28 days? A.—No, sir; the specifications did not call for sand tests. I made them, but the specifications did not call for them.

Q.—You only tested the neat cement? A.—I frequently made one to two and one to three sand tests, too, but the specifications did not require it.

Q.—In any of the tests made of the German Portland cement, did the strength exceed that of the steel cement? A.—Well, now, I don't know. I could not say as to that, without referring to my records.

Q.—What is your impression regarding that? A.—Well, they were pretty much the same; in the same general category, and I think all of them had more strength than the work could actually call into question. The ground here only stands about 1,000 pounds to the square foot, and the cement stands, one to three, anywhere from 300 to 400 pounds to the square inch in tension, which seems to me abundantly strong.

Q.—Then from your knowledge derived from making these tests and experiments with cement of different brands and manufactures, what is your judgment as to the relative value of steel cement as compared with the imported Portland cement, which would be furnished under the specifications for the work under contract in 1897? A.—The cement that would have passed the simple specification would be infinitely inferior to steel Portland cement. You had no chemical test at all. It might have contained any quantity of sulphur or magnesia, or anything else. You had to put further restrictions on it. It might have contained sand, and if very quick in setting, would have passed the 400 test in 7 days. It could have been coarsely ground, because a 2,500 mesh sieve don't mean anything at all. Particles that pass through a 2,500 mesh sieve have no value. The particles that are finer than 40,000 are the ones that count. The original specifications were no guard at all against an inferior cement.

Q.—Were the specifications subsequently prepared by Major

Harrod and yourself, in your opinion, an improvement over the original specifications? A.—I consider them a vast improvement.

Major Harrod—Did they give any better results in the work? A.—Very much better results.

The Chair—Has there not been great progress made in the manufacture of Portland cement, and particularly American Portland, since those first specifications were written? A.—I consider the modern American cement as the best in the market. No American engineer would dream of using anything else.

Q.—You don't mean to say that that was the case in 1885? A.—All recently erected cement plants use the rotary kiln, getting uniform results, and, it seems to me, a much higher grade of cement than we obtained previous to 1885, from anywhere. We don't manufacture three kinds of cement, under burnt, over burnt, and the right kind, but we manufacture the right kind all the way through. It is all right now, while formerly there was no way of telling, except by a chemical test, when you were going to get over burnt cement.

Mr. Benzenberg—I want to get one matter more clearly in my mind as to your judggment. The specifications subsequently drawn up and used for furnishing Portland cement or steel cement, secured to the drainage commission the use of a higher grade cement than that which could have been demanded under the general specifications first adopted? A.—Yes.

Q.—Would it have been possible for the Drainage Commission, or the Chief Engineer, to have exacted as good a quality of cement under the general specifications for imported Portland cement, as they could have exacted under the subsequent specifications? A.—They could not. Dealers in town told me that what they were bidding on was Belgium cement, and that that was what they intended to furnish under those specifications. They simply wanted to know whether these Belgium cements were good enough to come in under the specifications. I don't think any of them intended to furnish any of the well known group of German cements under those specifications. They intended to furnish Belgium cement, samples of which they brought up to me to test. Some of the pats from these cements cracked, but they said that did not amount to anything.

The intention was to furnish Belgium cements, which are not first-class.

Q.—There was a cause in the original specifications which said: "best imported cement?" A.—Yes, sir.

Q.—But that was coupled with this 400 pounds and this fineness. Now do you think, taking the usage of engineers throughout the world, a fair usage, that the engineers on the work could have properly interpreted this word "best" to mean anything more than the actual limitations which he had prescribed, that is, the minimum limitations. For instance, it says there shall be used on the work the best imported cement. It then went on to say if mixed neat (in the air 24 hours and in water 6 days) that it should stand at least 400 pounds and that the limit of fineness should not be less than 95 per cent passing through a 2,500 mesh screen. Now the question I ask, is, taking those limitations with that word "best," could the engineer have fairly asked for anything decidedly better than the limits that he had expressed? A.—The secondary qualifications expressed, are put in there to explain what is meant by the "best imported Portland cement." Those words are in shape of a definition, and having defined what you meant by best Portland cement, you cannot require anything more.

Q.—You judge that by the study of the literature of engineers throughout the country, do you? A.—Yes, sir.

The Chair—Wasn't that a fair specification for the best Portland cement, about ten years ago? A.—That was pretty nearly true, ten years ago, with the knowledge the people had at that period. The specifications were probably taken from the old text books, which have been generally changed. The greatest difference exists between the cement that goes through a 10,000 mesh sieve, and that which you get by shaking it and getting it through a big hole instead of an average hole.

Mr. Benzenberg—Have you at any time, been over any part of this work that is being constructed? A.—No, sir; not to such an extent as to enable me to give any expression of opinion concerning it.

Q.—Not officially, but you might have been over it and observed it from your natural interest therein? A.—Well, of course, at

times I have stopped and watched the method of putting the work down, but never with the view of expressing an opinion.

The Chair—You know, of course, as a Professor of Engineering, what the good character and bad character of work is, and did you observe in those trips of yours, at any time, any bad work? A.—No, sir; I think that, as a rule, the work seemed to be very good. The bricks were thoroughly wet, so that they did not dry the cement out, and, so far as I know, the work was good on the portions I observed.

Q.—As an engineer, and from your general observation of this work? A.—I think that the work is excellent. For instance, infinitely better than that one of the principal hotels here, where I saw them dump out a lot of the finest grade of German cement on the wharf, put a shovel through it three or four times and send up the mortar. The latter contained lumps of cement and of sand as big as one's head.

Mr. Benzenberg—Do you care to pass your opinion on some specifications for cement? I would ask you, Professor, to state whether the specifications marked C, of exhibit F, are equal to the requirements of those prepared by yourself and Major Harrod for steel cement? A.—The steel Portland cement is better than this. The steel Portland cement requires a higher quality of cement. It is safer. You don't know where you stand on this, there being nothing to show what deleterious substances it may contain. It may be a very rapid setting cement.

Q.—I would ask the same question with reference to the specification marked B, of exhibit F? A.—Yes, sir; steel cement is better than that.

Q.—The specifications under which the Drainage Commission obtains steel cement, requires a higher grade of material than these specifications would insure? A.—Yes, sir; no 28 days test there.

Q.—How about Portland cement, specification A, in exhibit F? A.—Yes, sir.

Q.—Will you please state what the specifications under A, in exhibit F, purport to be for? A.—A purports to be for cement; sand, rock and cement, for gun battery construction, Ft. St. Philip, La. If you desire, I can give you the reason why I think these are

defective as compared with the other. There is no sand test on that, at all.

Q.—These specifications were prepared by officers of the United States Government? A.—Yes, sir.

The Chair—In other words, the United States Government specifications for the year 1896, do not call for as good cement as the steel Portland cement, according to your test? A.—No, sir.

Mr. Benzenberg—Will you state what the specifications marked C, exhibit F, indicate as to where the cement should be used, and for what work? A.—To be used on work at Ft. St. Philip, La., August 8th, 1899.

Q.—The specifications marked B, exhibit F, what is that for? A.—It does not say here. It is for cement to be delivered at New Orleans, Natchez or Vicksburg.

Q.—How about the specifications marked D, exhibit F? A.—United States Engineer's office, for work at Ft. St. Philip, dated June 23rd, 1900.

Q.—How about the requirements of that specification as compared with the requirements for steel cement specified for the work to be done by the Drainage Commission? A.—It is better than this, because it contains all the specifications here, and more, too.

Q.—What is that date? A.—June, 1900.

Mr. Carson—Professor, do you know about the prices of so-called steel Portland cement, and other cements, in 1897, during the period when steel Portland cement was being used on the work? A.—No, sir; I made no investigation. I know what we paid for steel Portland, but I made no investigation as to what the other cements were worth.

Mr. Benzenberg—You do know what was paid for the steel Portland? A.—Only from what I was told. Not positively. I never saw the bills.

Q.—What was that price? A.—$1.65.

Mr. Carson—Delivered on the work? A.—I supposed that it was. I had no interest in that.

The Chair—That was the price in bags, not in barrels? A.—Yes, sir; in bags.

EXHIBIT "A."

SPECIFICATIONS FOR PORTLAND CEMENT, FOR USE IN CONNECTION WITH WORK—NEW ORLEANS DRAINAGE COMMISSION.

The cement shall be of the best quality of Steel Portland, and the average net weight per barrel shall not be less than three hundred and thirty-five (335) pounds. At least ninety (90) per cent, by weight, shall pass through a sieve of 40,000 meshes to the square inch.

A cement that cracks or checks when made into thin cakes, or that, when made into soft mortar, sets hard enough in less than thiry (30) minutes to bear a weight of one pound on a wire 1-24 inch in diameter, will not be accepted.

All tests of cements shall be made at or above a temperature of sixty (60) degrees Fahrenheit. Samples for testing may be taken from ten barrels of every lot of fifty barrels, and these samples shall be thoroughly mixed and made into briquettes, and, if the average strength of the ten briquettes is below that required, or if any two briquettes are ten (10) per cent below the required strength, it shall be sufficient cause for rejection of all the barrels in the same lot from which the samples were taken.

Tests will be made with cement mixed neat, and also with three parts of sand to one of cement, and briquettes of each ten barrel samples will be exposed one day in air and six days in water, and one day in air and twenty-seven in water before they are tested.

Cements must correspond with labels on their barrels or sacks, in composition, weight, maker, and place of manufacture. Bills of lading must be furnished, if required.

No cements that are known to be adulterated cements, shall be presented for testing. No adulterated cements will be allowed. Portland cements, when analyzed, must be within the following limits:

Silica.....20 to 29 per cent.
Alumina, plus oxide iron.....5 to 13 per cent.
Lime.....50 to 65 per cent.
Magnesia.....0 to 3 per cent.
Sulphuric acid.....0 to 1½ per cent.

The presence of unhydrated, or under-burnt lime, or sulphuric acid, or magnesia, in quantities sufficient to be dangerous to the future soundness of the cement, will be cause for rejection. No over-limed or non-uniformly ground cement will be allowed. Hot and cold tests will be made for soundness.

Gilmore's needles will be used for testing set. Specific gravity and chemical analysis will be made, for detection of adulteration or under-burning.

Portland cement must show the following tensile strength, in pounds, per square inch, when tested in accordance with the Am. Soc. Civil Engineers' Rules. Spalding on hydraulic cement, will be used as authority.

	Neat.	Sand 1:3
Seven days	400	125
Twenty-eight days	500	175

Tests will be made by Prof. W. H. P. Creighton, of the Tulane Testing Laboratory, and the acceptance or rejection of material will be determined by these tests.

THE DRAINAGE COMMISSION OF NEW ORLEANS.

NEW ORLEANS, LA., SEPT. 3rd, 1897.

Mr. F. P. Mullen, Supt. Nat. Contr. Co.:

DEAR SIR—I herewith enclose copy of specifications for Portland Cement, as agreed on in conference yesterday afternoon.

The Steel Portland Cement will be accepted, provided it fully complies with these specifications, as interpreted by Prof. Creighton. Very respectfully,

(Signed) B. M. HARROD,
Chf. Engr.

State of Louisiana :
Parish of Orleans :

MEMORANDUM of contract this day entered into by and between the ILLINOIS STEEL COMPANY of Chicago, party of the first part, herein represented by Jasper Whiting, Manager of the Cement Department, and the NATIONAL CONTRACTING COMPANY, party of the second part, herein represented by Frank P. Mullen, Superintendent, witnesseth:—

That, whereas the party of the Second part has entered into contract with the New Orleans Drainage Commission to construct part of the drainage work of said City, in the execution of which contract the use of a large amount of "Portland Cement" will be necessary, supposed at this time to be about thirty thousand barrels, more or less,

Now, therefore, the party of the first part hereby agrees and binds itself to sell, furnish and deliver to the party of the second part all of the "Portland Cement" that may be used in the execution of the said contract, excepting in such particular parts of the work where the Engineer of the Drainage Commission may order a different brand, whatever the amount thereof above or below the said thirty thousand barrels.

All cement to be delivered under this contract is to be "Steel Portland Cement," and is guaranteed to stand at all time the inspection and test that may be required by the Officials of the Drainage Commission.

Said Cement to be delivered in quantities called for on three weeks' prior notice, not, however, to exceed fifteen hundred barrels per week, in paper sacks of not more than four sacks to the barrel of three hundred and thirty-five pounds, f. o. b. cars New Orleans.

It is hereby understood and agreed that three hundred and thirty pounds of "Steel Portland Cement" shall be at least equal in volume to three hundred and eighty pounds Imported Portland Cement of standard brand: this volume to be determined by comparing three hundred and thirty-five pounds "Steel Portland Cement" in the loose, with three hundred and eighty pounds of Imported Portland Cement, in the loose. If the volume of three hundred and thirty-five pounds "Steel Portland Cement" is found

to be less than herein agreed, then the party of the first part, agrees to accept in payment of said cement, a price of as much less of $1.57 per barrel of three hundred and thirty-five pounds, as the per cent of difference in volume. In other words, if the difference in volume is one per cent less than herein agreed, then the prices shall be reduced one per cent.

And the party of the second part hereby agrees and binds itself, to pay the party of the first part, for all Cement delivered under this contract, One Dollar and Fifty-Seven cents per barrel of 335 pounds, and of volume above specified, f. o. b. cars, as aforesaid. Payments to be made, on the first of each month to the amount of eighty per cent of amount due, the twenty per cent to be retained until completion of contract, but no longer than eight months from the date hereof.

And in case of default by the party of the first part in timely shipment of cement of the quality and quantity, as per specifications agreed on by the Drainage Commission of the City of New Orleans and the National Contracting Company, as also the chemical test specified by the official Cement inspector of said Drainage Commission, all of which is hereto annexed, signed, and made part of this contract, the party of the second part shall have the right to buy such cement or other cement that will comply with said specifications, from other persons, and to charge the party of the first part with the difference between the price paid therefor, and the price herein agreed upon, but in no event, shall this price exceed fifteen cents per barrel above the contract price for "Steel Portland Cement."

It is expressly understood and agreed, that any accident, fire, strike, or anything whatsoever, beyond the control of the Illinois Steel Company, shall not lay them liable.

Thus done and signed in duplicate this 3d day of September, 1897.

(Signed) ILLINOIS STEEL COMPANY,
By Jasper, Whiting,
Mgr. Cement Dept.

Witness:
Columbus Bierce,
G. F. Chase.

THE NATIONAL CONTRACTING COMPANY,
Frank P. Mullen, Supt.

[illegible] the required
[illegible] all the barrels
[illegible] taken.
[illegible] also with three
[illegible] of each ten barrel

samples, will be exposed one day in air and six days in water, and one day in air and twenty-seven in water, before they are tested.

Cements must correspond with labels on their barrels or sacks, in composition, weight, maker, and place of manufacture.

Bills of lading must be furnished, if required.

No cements that are known to be adulterated cements, shall be presented for testing. No adulterated cements will be allowed.

Portland cements, when analyzed, must be within the following limits:

Silica	20 to 29 per cent.
Alumina, plus oxide iron	5 to 13 per cent.
Lime	50 to 60 per cent.
Magnesia	0 to 3 per cent.
Sulphuric acid	0 to 1½ per cent.

The presence of unhydrated, or under-burnt lime, or sulphuric acid, or magnesia, in quantities sufficient to be dangerous to the future soundness of the cement, will be cause for rejection.

No over-limed or non-uniformly ground cement will be allowed.

Hot and cold tests will be made for soundness.

Gilmore's needles will be used for testing set. Specific gravity and chemical analysis will be made, for detection of adulteration or under-burning.

Portland cement must show the following tensile strength, in pounds, per square inch when tested in accordance with the Am. Soc. Civil Engineers' rules. Spalding on hydraulic cement, will be used as authority.

	Neat.	Sand 1:3
Seven days	400	125
Twenty-eight days	500	175

Tests will be made by Prof. W. H. P. Creighton, of the Tulane Testing Laboratory, and the acceptance or rejection of material will be determined by these tests.

B. M. HARROD,
Chf. Eng., D. C. of N. O.

Witness:
COLUMBUS BIERCE,
G. F. CHASE.

(Signed) ILLINOIS STEEL CO.,
By Jasper Whiting, Mgr. Cement Dpt.
THE NATIONAL CONTRACTING COMPANY,
Frank P. Mullen, Supt.

EXHIBIT "B."

NEW ORLEANS, LA., MARCH 17, 1902.

Board of Engineers, Drainage Commission of New Orleans, City:

GENTLEMEN—In response to your request I herewith submit to you a memorandum of departures from the plans and specifications originally prepared for the Drainage System of this city, as they were submitted to the public for purposes of taking bids.

These departures may be classified under two categories.

First—Structural changes, in the location of canals, methods of construction, character of materials required, and other matters of a purely engineering nature.

Second—Departures from contracts, specification, and payments provided when the first work was let.

The changes in the first named category that have come to my attention are as follows:

(a) *Changes in location of Toulouse Canal.* This change was made upon the insistence of the Contractor, because the location was too close to the Carondelet Navigation Canal for safety. Mr. L. W. Brown, our engineer at the time, recommended it, and the Drainage Commission itself directed it, upon the advice of its Engineer. The change was necessary and wise.

(b) *Increase in the lift of pumps at Pumping Station No. 2.* This change is now being made. It is necessary on account of the indefinite postponement of the completion of the outfall canal into Lake Borgne, causing sediment to collect in the canal between Station No. 2 and Station No. 7. The change was suggested by us to the Engineer of the Commission and the Arbitration Committee, which met in August, 1901, to adjust the differences between ourselves and the Drainage Commission then existing. It was directed by the Commission.

Both of these changes involved alterations in our contract relations with the Commission.

(c) *Change in location of Pumping Station No. 1.* I am not familiar with the causes for this, which I have had no reason to investigate.

(d) *Use of sheet piling.* The original plans and specifications and estimates for Contract "C" made no provision for sheet piling or for sheeting and bracing the trenches of lined and covered canals, or for payment for that work. It was necessary to provide for this in order to carry out the work. Payment for this was a matter of much contention, and was finally settled by the Arbitration Committee.

There were many minor changes in location and sizes of canals from those on the first plans prepared, but these did not involve departures from the original plans or specifications.

None of these changes mentioned hitherto involved any change of materials or workmanship from those originally called for.

In executing the contracts recently let there are several departures from the designs and methods employed on previous work. They are as follows:

(e) *The use of gravel instead of Lake shells for concrete.* This is an improvement. Your inspection of the concrete now being laid is invited.

(f) *Concrete-steel covers substituted for brick arches and I-beams.* This is a structural improvement, and a cheaper construction also. The city is getting the benefit of the saving.

The departures from the methods of procedure expected on Contracts "A," "C," and "D" at the time bids were received, which involved legal considerations, are as follows:

(g) *Contracts "A," "C," and "D" were placed in one contract.* Upon the strength of this consolidation the Drainage Commission subsequently demanded of the Contractor things which they would not have demanded under any of the three separate contracts bid upon. This gave rise to much contention at a later date. It was unnecessary, and we think an error. Neither party anticipated the misunderstanding which arose later, regarding acceptance of the work and payments therefor.

(h) *A telephone system was added to the contract without compensation to the Contractor.*

(i) *Contract "C" was extended by the Commission with the consent of the Contractor* to include canals adjoining those bid upon. Accepting this extension was an error of judgment on the part of the contractor, as he lost much money thereby. The work did not

entirely correspond to that bid upon, the canals added to the contract being smaller and their location less favorable for the work.

(j) *The old drainage machines in various parts of the city were removed before the new stations were tested and accepted.* This made it necessary to employ the new stations for drainage purposes for a long period before their acceptance, which was not contemplated in the contract, and introduced certain complications in contract relations.

(k) *The time required to complete the work was erroneously estimated by both the Contractor and the Commission.* This has caused much criticism of both the Drainage Commission and the Contractor. There has never been a fair public analysis of the various causes of the delay, and the statements that have appeared in the press in regard to this matter are misleading. Paragraph 18 of the General Specifications defines the course to be followed in case the work is unnecessarily delayed by fault or failure of the Contractor, and paragraph 6 places the order of procedure at the discretion of the Engineer. Pumping Station No. 2 has been delayed beyond all expectations, but the whole of the delay is not due to errors of the Contractor. The conditions which have made necessary the furnishing of a complete equipment of machinery at this Station, were entirely unforseen, and at no time would the public interest have been served by placing this station in other hands. The matters connected with this station, including delay, were thoroughly investigated by the Arbitration Committee, and settled acceptably to both parties. We request permission to place before you a statement of delays and their causes and if you find any additional investigation of this matter necessary.

(l) *The Commission declines to be bound by paragraph 4, page 6 of the General Specifications, or by the Arbitration Committee selected by mutual agreement,* alleging that the paragraph is illegal, and the agreement fictitious. This forces the Contractor into Court with certain claims.

These are all the departures from the original specifications of which I am aware of, so far as the old contracts are concerned.

The new contracts "I," "J," "K," "L," "M," and "N" contain provisions not contemplated in the original scheme, the more important of which are as follows:

(m) *A more definite specification is provided for Cement* than can anywhere be found in the General Specifications.

(n) *Certain clauses in the original General Specifications are omitted in the new.* These omissions, we think, are entirely judicious.

(o) *A limit is placed upon the amount of street which may be kept open, and a forfeiture placed* for failure to close the street at the end of certain time. This appears to us a wise provision.

(p) *A forfeiture* ($200 per day) *is placed for non-completion of each contract at a certain date.* This appears to us a wise provision, but the wording of the clause seems to us extremely bad, as it is intended to limit the legal discretion of the Commission. We protested to the wording when we signed the new contracts. We think the spirit of paragraph 229 of the original General Specifications should not have been departed from, but that the forfeiture clause might have been added thereto. We see no mutuality in the wording of this clause in the new contract, and that wording is not found in any specifications whatever, and was not a condition of the bids.

(q) *Clauses regarding extension and curtailment of work are more clearly expressed in the General Specifications than in the Special Specifications.*

This interpretation placed on the Special Specifications by the Attorney of the Commission in recent reports to that body would give the Engineer more power than provided in the original plan, and more power than the Commission itself, either to the detriment or advantage of the Contractor.

Two other matters have come up in connection with the new work, which are not recorded as having caused disagreement on the old, involving the Contractor with the Commission. They are

(r) *The removal and relaying of water pipe and gas pipe,* covered by paragraph 50 of the General Specifications. This caused friction which has been terminated by decision of the Court in favor of the Water Works Co., directing the Commission to remove and relay, or otherwise preserve this pipe. For extra expense on account of this pipe the National Contracting Company has a bill of $9061.75 against the Commission, which could have

been saved had the Commission removed the pipe instead of contesting the claim of the Water Works Company.

(s) *In Claiborne street the intention of filling up the old canal with material taken from the new, and matters of drainage connected therewith, were not indicated in the plans or specifications.* This has caused some initial difference of opinion regarding methods of carrying out the work between the Engineer and the Contractor. The work is being carried on so as to reduce such expense to a minimum, and when it is completed the Engineer will be called upon to determine the amount of extra work. The purely local conditions are different in this system from what they are in any other, while the specifications are the same.

These are all the departures from the original intentions of the Advisory Board of which I know. You will notice that those which are of the greatest structural importance were directed by the Commission upon the advice of the Engineer. Many of the causes of friction in the conduct of this work lay in the difference in interpretation of the auxiliary documents to those specifications by the advisers of the Drainage Commission and the National Contracting Company, and not in the Engineering Department. In the conduct of the work I have found the Engineer always ready to give his sanction to any suggestion which would facilitate or improve, but only upon thorough investigation and test, and I believe that no work which he thought inferior to the standard called for in the specifications has been accepted.

Allow me to repeat what I have already assured you verbally, that the National Contracting Company places at your disposal all of its office records and the help of its office force to find any documents you may require. We will be glad to furnish you with complete statements of cost of any or all of the items of our work, and to enable you, or such persons as you may designate, to verify them to the utmost. For the design of the system we are not responsible; but that all materials are as represented, and that all work is properly done, we are responsible; and we hope that the investigation you are making will be most exhaustive in this regard.

Very respectfully,

(Signed) WM. MAYO VENABLE,
Local Manager, The National Contracting Co.

EXHIBIT "C."

LIST OF CHANGES OF LOCATION AND ALIGNMENT.

Omission of Pumping Station No. 8. Directed by Advisory Board.

Change of location of Pumping Station No. 3.

Change of location of canal from Broad to Marigny Avenue and Pumping Station No. 3.

Change of location of Pumping Station No. 1. Authorized by the Drainage Commission.

Change of location of Melpomene canal from Claiborne to Pumping Station No. 1. Authorized by Drainage Commission.

Change of location of Pumping Station No. 6 to N. O. & W. R. R. Authorized by Drainage Commission.

Change of Third Street System from Carondelet to St. Charles. Authorized by Drainage Commission to avoid street railroad and large trees.

Addition of Perrier street canal, leaving existing canal on Pitt street.

Change from Jeannette to Birch street to avoid street railroad.

Change from Burgundy to Rampart and St. Claude to avoid car tracks and asphalt pavement.

Omission of Tulane canal by direction of Advisory Board.

New Orleans, La., March 17th, 1902.

EXHIBIT "D."

LIST OF COMPLETED WORK.

Metairie Releif Outfall, Pumping Station No. 6 to Lake, 12,000 feet.

Orleans Relief Outfall, Pumping Station No. 7 to Lake, 10,000 feet.

London Relief Outfall, Pumping Station No. 3 to Lake, 13,000 feet.

Metairie Relief Canal, Pumping Station No. 1 to Pumping Station No. 6, 17,000 feet.

Orleans Relief Canal, Pumping Station No. 2 to Pumping Station No. 7, 13,000 feet.

Dublin Canal, Claiborne Street to Seventeenth Street, 5,000 feet.

Claiborne Canal, Dublin Street to Nashville Street, 5,500 feet.

Melpomene Canal, Pumping Station No. 1 to Claiborne Street, 3,500 feet.

Claiborne Canal, Third Street to Melpomene Street, 1,800 feet.

Third Canal, St. Charles Street to Claiborne Street, 5,000 feet.

St. Charles Canal, Third Street to Louisiana Avenue, 2,100 feet.

St. Charles Canal, Third Street to Felicity Street, 2,900 feet.

St. Louis Canal, Pumping Station No. 2 to Basin Street, 5,500 feet.

Galvez Canal, Julia Street to St. Louis Street, 4,500 feet.

Claiborne Canal, Julia Street to St. Louis Street, 4,500 feet.

Basin Canal, Julia Street to St. Louis Street, 4,700 feet.

Julia Canal, Basin Street to Constance Street, 2,800 feet.

Constance Canal, Howard Street to Julia Street, 900 feet.

Camp Canal, Lafayette Street to Julia Street, 700 feet.

Canal Canal, Basin Street to Chartres Street, 2,100 feet.

Camp Canal, Lafayette Street to Canal Street, 1,500 feet.

Chartres Canal, St. Louis Street to Canal Street, 1,600 feet.

Main Canal, Elysian Fields Street to Jourdan Avenue, 12,500 feet.

Main Outfall, Pumping Station No. 5 to Bayou Bienvenue, 6,300 feet.

Lafayette Canal, Florida Avenue to Claiborne Street, 4,000 feet.
Jourdan Canal, Florida Avenue to St. Claude Street, 6,500 feet.
Claiborne Canal, Elysian Fields Street to Lafayette Street, 2,500 feet.
Claiborne Canal, Independence Street to Lafayette Street, 4,000 feet.
Claiborne Canal, Jourdan Avenue to Independence Street, 4,000 feet.
Claiborne Canal, Jourdan Avenue to Adams Street, 4,000 feet.
Metairie Pumping Station No. 6.
Orleans Pumping Station No. 7.
Algiers Pumping Station No. 8.
Jourdan Pumping Station No. 5 (part installation).
Central Electric Station (part installation).

LIST OF WORK UNDER CONTRACT.

St. Louis Pumping Station No. 2.
Melpomene Pumping Station No. 1.
St. Bernard Pumping Station No. 3.
Leonidas Canal, Birch Street to Spruce Street, 1,400 feet.
Birch Canal, Upper Levee to Leonidas Street, 1,400 feet.
Birch Canal, Carrollton Avenue to Leonidas Street, 1,600 feet.
Lowerline Canal, Wall Street to Jeannette Street, 5,200 feet.
Wall Canal, Park Street to Lowerline Street, 1,200 feet.
Pearl Canal, Short Street to Lowerline Street, 1,600 feet.
Jeannette Canal, Carrollton Street to Lowerline Street, 2,100 feet.
Third Canal, St. Charles Street to Constance Street, 2,400 feet.
Constance Canal, Louisiana Avenue to Third Street.
Constance Canal, St. Mary Street to Third Street.
St. Mary Canal, Constance Street to Laurel Street.
Laurel Canal, St. Mary Street to Felicity Street.
St. Bernard Canal, Claiborne Street to St. Claude Street, 2,000 feet.
St. Claude Canal, Elysian Fields Street to St. Bernard Street, 1,600 feet.
St. Claude Canal, Esplanade Street to St. Bernard Street, 800 feet.

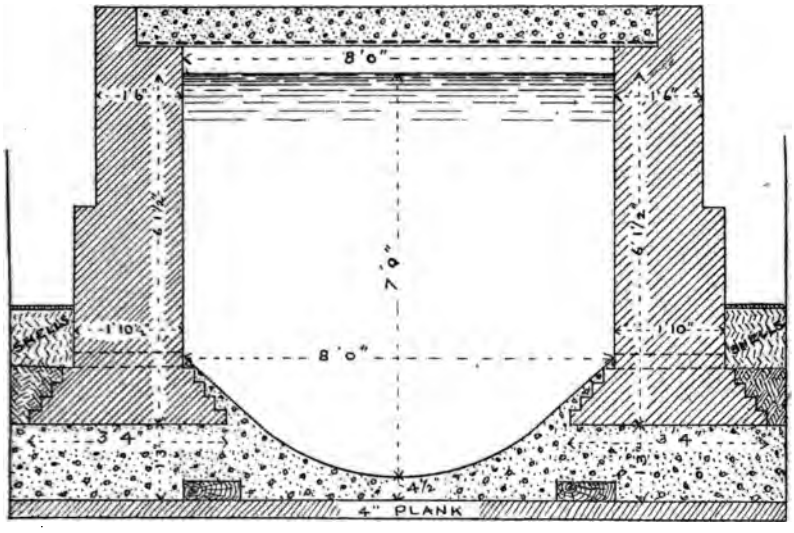
Esplanade Canal, St. Claude Street to Rampart Street, 400 feet.
Rampart Canal, Esplanade Street to St. Peter Street, 2,450 feet.
Claiborne Canal, Esplanade Street to St. Bernard Street, 1,500 feet.
Claiborne Canal, Elysian Fields Street to St. Bernard Street, 2,300 feet.
Eliza Canal, Vallette Street to Bouny Street, 1,400 feet.
Eliza Canal, Vallette Street to Pacific Street, 1,000 feet.
Vallette Canal, Eliza Street to Lapeyrouse Street, 3,150 feet.
Lapeyrouse Canal, Vallette Street to Canal Avenue, 2,700 feet.
Canal Canal, Lapeyrouse Street to Pumping Station No. 8, 1,300 feet.
Algiers Outfall, beyond Pumping Station No. 8, 1,000 feet.
Nashville Canal, Constance Street to Rampart Street, 4,100 feet.
Constance Canal, Park to Nashville Street, 2,650 feet.
Constance Canal, Peters Avenue to Nashville Street, 1,250 feet.
Perrier Canal, Park to Nashville Street.
Perrier Canal, Soniat Street to Nashville Street.

LIST OF WORK ADVERTISED.

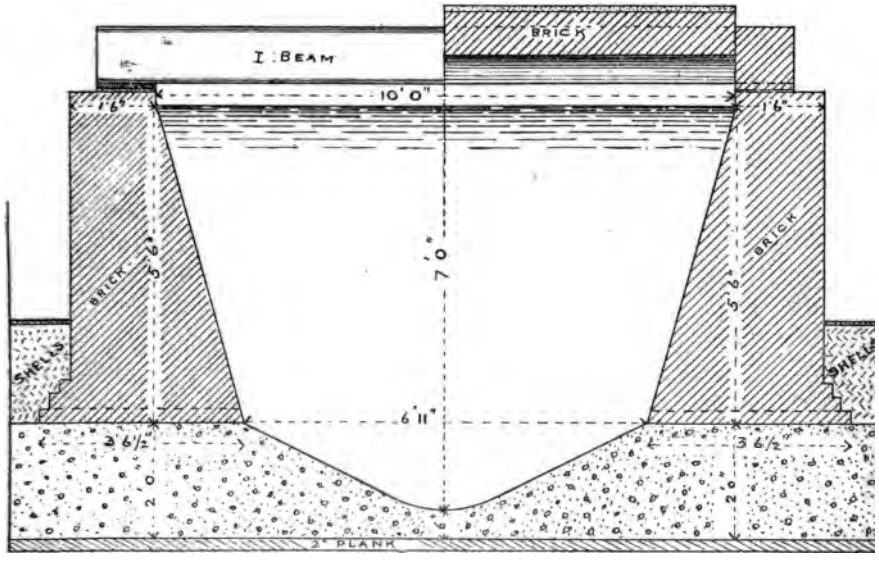
Leonidas Canal, Spruce Street to Claiborne Street, 1,400 feet.
Claiborne Canal, Leonidas Street to Dublin Street, 1,400 feet.
Lowerline Canal, Jeannette Street to Claiborne Street, 3,300 feet.
Nashville Canal, Rampart Street to Claiborne Street, 4,400 feet.
St. Bernard Canal, Claiborne Street to Broad Street, 4,300 feet.
Broad Canal, St. Bernard Street to Pumping Station No. 3, 2,400 feet.

EXHIBIT "E."

OLD AND NEW SECTIONS OF SMALL CANALS.



NEW SECTION OF CANAL.
AREA 51 SQ. FT.



OLD SECTION OF CANAL.
AREA 51 SQ. FT.

EXHIBIT "F."

COPIES OF BIDS ON PORTLAND CEMENT TO U. S. GOVERNMENT AND SPECIFICATIONS—1896 TO 1900.

NEW ORLEANS, MARCH 17th, 1902.

Rudolph Hering, Esq., Chairman, Board of Engineers, The Drainage Commission of New Orleans, City:

DEAR SIRS—In accordance with my promise this morning, I beg to give you copies of bids on Portland Cement to the U. S. Government, within the last few years. I would state that until the latter part of last year, my business was conducted in the name of The National Building Supply Co., of Baltimore, Md., which company has since retired from this market.

February 27th, 1896.

Major Jas. B. Quinn, for 4,000 barrels, to be delivered at Fort St. Philip, La.:

Jas. G. Clark & Co., for "Lagerdorfer" brand.....$2.85
Jas. G. Clark & Co., for "B. S. & Co." brand.....$2.69
Atlas Cement Co., for "Atlas" brand.....$2.82
J. E. Crusel, for "Germania" brand.....$2.75
The National Bldg. Sup. Co., for "Porta and "Kaiser" brand.$2.55

The contract was awarded to my company, and we furnished 4,800 barrels, being the 20 per cent additional quantity, which the company had the right to order, under the terms of contract. The lighterage to Fort St. Philip was 25c. per barrel, making a net price (ex. ship) of $2.30 per barrel. I enclose copy of specifications marked "A".

On November 2nd of the same year (1896) I made a supplemental contract for the delivery of 5,500 barrels of the above named brands at Fort St. Philip at the price of $2.20 per barrel delivered there, which contract I carried out, stopping two ocean steamers at Fort S. Philip, to make the required deliveries.

July 18th, 1899.

Major Geo. McC. Derby, for 1,000 barrels delivered f. o. b. barge in New Orleans:

R. M. Ong, for "Atlas" or "Teutonia".....$2.45
J. Watts Kearny & Sons, for "Hercules".....$2.30
Jas. G. Clark, for "Lagerdorfer" ex. steamer.....$2.40
" " " ex. warehouse.....$2.50
The National Building Sup. Co., for "Porta".....$2.40

I enclose copy of specifications, marked "B".

August 8th, 1899.

Major Geo. McC. Derby, for 3,300 barrels, delivered f. o. b. barge in New Orleans:

South Eastern Lime & Cement Co., for "Hercules".....$2.38
J. Watts Kearny & Sons, for "Teutonia".....$2.43
Jas. G. Clark, for "Lagerdorfer," ex. steamer.....$2.40
" " " ex. warehouse.....$2.50
R. M. Ong, for "Hemmoor," "Teutonia," or equal.....$2.35
The National Building Sup. Co., for "Porta".....$2.45

The specifications are similar to those marked "B".

August 8th, 1899.

Major Jas. B. Quinn, for 50 tons Imported (true) Portland Cement (Lot No. 1), or 35 tons American (true) Portland Cement (Lot No. 2):

R. M. Ong, Lot No. 1.....$795.00
" " Lot No. 2.....$582.75
J. Watts Kearny & Sons, Lot No. 1.....$750.00
Jas. G. Clark, Lot No. 1.....$812.50

I enclose copy of specifications, marked "C".

April 20th, 1900.

Major Geo. McC. Derby, for 10,000 barrels delivered f. o. b. barge in New Orleans.

Ong-Hiller Co., for "Atlas," (in wood).....$2.53
" " " " (in jute bags).....$2.33
Ong-Hiller Co., for "Hemmoor".....$2.27

J. Watts Kearny & Sons, for "Hercules".....$2.30
Jas. G. Clark, for "Lagerdorfer".....$2.40
The National Bldg. Sup. Co., for "Porta" or "Kaiser".....$2.39
Holden & Hartigan Co., Ltd., for "Vulcanite".....$2.57

The specifications are almost identical with those marked "B".

July 3rd, 1900.

Major H. M. Adams, for 1,000 barrels to be delivered at Fort St. Philip, La.

Holden & Hartigan (Limited), for "Vulcanite".....$2.83
The National Building Supply Co., for "Star".....$2.88
R. M. Ong, for "Atlas".....$2.69
Allen Tupper, for "Vulcanite".....$2.67

I enclose copy of specifications, marked "D".

There are a few later bids to he Government, but I think the foregoing will give you the information desired, and, in the short time at my disposal, I have not been able to make as complete a report as I would wish.

I trust the information will be of service to you in the present investigation, and I will be happy to be of any further service if in my power; meanwhile, I remain,

Yours respectfully,

(Signed) E. W. FISHER.

ADVERTISEMENT, INSTRUCTIONS, SPECIFICATIONS, PROPOSALS, ETC., FOR SAND, ROCK AND CEMENT FOR GUN BATTERY CONSTRUCTION, FORT ST. PHILIP, LA.

ADVERTISEMENT.

U. S. ENGINEER'S OFFICE, 349 Carondelet Street,
NEW ORLEANS, LA., JANUARY 27, 1896.

Sealed proposals for furnishing Sand, Rock and Cement for Gun Battery Construction at Fort St. Philip, La., will be received here until 12 o'clock noon, February 27, 1896, and then publicly opened. Information furnished on application.

JAMES B. QUINN,
Major, Engineers.

SPECIFICATIONS.

General Instruction for Bidders.

1. The attention of bidders is especially invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, as printed in vol. 33, page 332, and vol. 24, page 414, United States Statutes at Large, which prohibit the importation of foreigners and aliens, under contract or agreement, to perform labor in the United States or territories or the District of Columbia.

2. Preference will be given to articles or materials of domestic production, conditions of quality and price being equal, including in the price of foreign articles the duty thereon.

3. Maps of the localities may be seen at this office. Bidders or their authorized agents, are expected to visit the place and to make their own estimates of the facilities and difficulties attending the excution of the work, including the uncertainty of the weather and all other contingencies.

4. No proposal will be considered unless accompanied by a guarantee in manner and form as directed in these instructions.

5. All bids and guarantees must be made in triplicate, upon printed forms to be obtained at this office.

6. The guaranty attached to each copy of the bid must be signed by two responsible guarantors, to be certified as good and sufficient guarantors by a Judge of the United States Court, United States District Attorney, Collector of Customs, or any other officer under the United States Government.

7. A firm will not be accepted as surety, nor will a partner be accepted as surety for a co-partner or for a firm of which he is a member. An officer of a corporation will not be accepted as surety for such corporation. Sureties must be citizens of the United States.

8. Each signature in proposals, guarantees, contracts, and bonds shall have affixed to them seals of wax, wafer, or other adhesive substance, and should be written out in full, and the signatures to the guarantees, contracts, and bonds should be attested by at least one witness, and when practicable by a separate witness to each signature.

9. Each guarantor will justify in the sum of five thousand

(5000) dollars. The liability of the guarantors and bidder is determined by the Act of March 3, 1883, 22 Statutes, Chap. 120, and is expressed in the guarantee attached to the bid.

10. When firms bid, the individual names of members, should be written out, and should be signed in full, giving the Christian names; but the signers may, if they choose, describe themselves in addition as doing business under a given name and style as a firm.

11. The place of residence of every bidder, and postoffice address, with county and State, must be given after his signature.

12. All prices must be written as well as expressed in figures.

13. One copy each of the advertisement, the instructions for bidders, and the specifications, all of which can be obtained at this office on application by mail or in person, must be securely attached to each copy of the proposal and be considered as comprising a part of it.

14. Proposals must be prepared without assistance from any person employed in or belonging to the military service of the United States or employed under this office.

15. No bidder will be informed, directly or indirectly, of the name of any person intending to bid or not to bid or to whom information in respect to proposals may have been given.

16. Any one signing the proposal as the agent of another or others must file with it legal evidence of his authority to do so.

17. All blank spaces in the proposal and bond must be filled in, and no change shall be made in the phraseology of the proposal, or addition to the items mentioned therein. Any conditions, limitations, or provisos attached to proposals will be liable to render them informal, and cause their rejection.

18. Alterations by erasure or interlineation must be explained or noted in the proposal over the signature of the bidder.

19. If a bidder wishes to withdraw his proposal, he may do so before the time fixed for the opening, without prejudice to himself, by communicating his purpose in writing to the officer who holds it, and, when reached it shall be handed to him or to his authorized agent, unread.

20. Reasonable grounds for supposing that any bidder is interested in more than one bid for the same item will cause the rejection of all bids in which he is interested.

21. No bids received after the time set for opening of proposals will be considered.

22. The proposals and guarantees must be placed in a sealed envelope marked "Proposals for Stone, Sand and Cement for Fort St. Philip, La.," and enclosed in another sealed envelope addressed to Major James B. Quinn, Corps of Engineers, 349 Carondelet street, New Orleans, La. The outer envelope must be so indorsed as to indicate before opening the particular work for which the bid is made.

23. The United States reserves the right to reject any and all bids, and to waive any informality in the bids received; also to disregard the bid of any failing bidder or contractor known as such to the Engineer Department.

24. The bidder to whom the award is made will be required to enter into written contract with the United States, with good and approved security, in an amount of five thousand (5000) dollars, within ten (10) days after being notified of the acceptance of his proposal.

25. The contract which the bidder and guarantors promise to enter into shall be, in its general provisions, in the form adopted and in use by the Engineer Department of the Army, blank forms of which can be inspected at this office, and will be furnished if desired to parties proposing to put in bids. Parties making bids are to be understood as accepting the terms and conditions contained in such form of contract.

26. The sureties are to make and subscribe affidavits of justification on the back of the bond to the contract and they may jointly justify in double the amount of the penalty.

27. Bidders are invited to be present at the opening of bids.

General Conditions.

28. A copy of this advertisement, specifications, and instructions will be attached to the contract and form a part of it.

29. The contractor should, within ten days from the award of the contract, furnish the office with the postoffice address to which communications should be sent.

30. Transfers of contracts, or of interests in contracts, are prohibited by law.

31. The contractor will not be allowed to take advantage of any error or omission in these specifications, as full instructions will always be given should such error or omission be discovered.

32. The decision of the Engineer Officer in charge as to quality and quantity shall be final.

33. It is understood and agreed that the quantities given are approximate only, and it must be understood that no claim shall be made against the United States on account of any excess or deficiency, absolute or relative, in the same. Bidders are expected to examine the drawings, and are invited to make the estimate of qualities for themselves.

34. Payments will be made monthly. A percentage of ten (10) per centum will be retained from each payment until the completion of the contract.

35. Should the time for the completion of the contract be extended, all expenses for inspection and superintendence during the period of the extension, the same to be determined by the Engineer officer in charge, shall be deducted from payments to become due to the contractor; *Provided, however,* that if the party of the first part shall, in the exercise of his discretion, because of freshets, ice, or other force or violence of the elements, allow the contractor additional time in writing as provided for in the form of contract, there shall be no deduction for the expense for inspection and superintendence for such additional time so allowed; *Provided further,* that nothing in these specifications shall affect the power of the party of the first part to annul the contract as provided for in the form of contract adopted and in use by the Engineer Department of the Army.

Quantities and Qualities.

36. That all material purchased under the foregoing provisions of this Act shall be of American manufacture, except in cases when, in the judgment of the Secretary of War, it is to the manifest interest of the United States to make purchases in limited quantities abroad, which material shall be admitted free of duty.

37. The cement must be a high grade Portland. Samples will be taken at random out of every shipment, at least one sample for

every hundred barrels, which will be tested and must fulfill the following requirements:

(1) It must be finely ground so that not exceeding twenty per cent shall be retained by a No. 100 sieve having 1,000 meshes per square inch, and not more than 5 per cent by a No. 50 sieve, having 2,500 meshes per square inch.

(2) Briquettes of one square inch section must have the following tensile strength:

Mixed neat, after one day.....120 lbs.
Mixed neat, after seven days.....325 lbs.
Mixed neat, after thirty days.....450 lbs.

(3) The briquettes after having set and being immersed in water must not show cracks or checks, and must not crumble. A cement that cracks or checks when made into thin cakes will not be accepted.

38. Cement will be accepted after examinations and tests have been made which prove that its quality has not deteriorated, and that it fulfills the above requirements.

39. The sand must be coarse river sand, sharp and clean.

40. The rock must have a hardness equal to vitrified brick, and a weight not less than 150 lbs. per cubic foot.

41. Bidders on sand and rock must accompany their proposal by samples of material which they propose to furnish and the successful bidder will be required to furnish material of same quality as his sample.

42. Separate bids will be received for cement, sand, and rock. The right is reserved to increase or decrease the amount of estimated quantities 20 per cent.

43. There will be needed for the work:

Cement, about 4,000 barrels of average weight not less than 400 lbs. each.

Sand, about 2,000 cubic yards.

Rock, about 6,300 cubic yards of the following classes:

1st Class: 900 cubic yards of rocks in pieces of 50 lbs. and 100 lbs., of clean fracture and with no rounded or worn surfaces.

2nd Class: 3,400 cubic yards of broken stone of sizes

which will pass through 2-inch rings and which will not pass through ¾-inch square meshes.

3rd Class: 2,000 cubic yards of crushed rock of sizes which will pass through ¾-inch square meshes but will not pass through ¼-inch square meshes. Equally hard and durable gravel of same sizes may be substituted for not to exceed one-half this amount, at the option of the contractor.

Measurement.

44. The rock and sand will be measured in the bins or pile where delivered.

Delivery.

45. The sand and rock are to be delivered at such place inside the levee, but not to exceed 100 feet from it, at Fort St. Philip, La., as the Engineer in charge shall designate. The cement shall be delivered on the wahrf in barrels unbroken and uninjured, and in lots not to exceed 800 barrels. The contractor will be notified when any material is desired and in how great quantities, and delivery must be made within ten days thereafter.

SPECIFICATIONS.

1. *Quantiy*—Contract will be made for 1,000barrels of Portland Cement, or 3,000 barrels of Natural Cement. The right is reserved to increase the quantity by 20 per cent or less.

2. *Quality*—The Cement must be in good order, of uniform quality, setting well both in air and water, and free from anything that may cause the mortar to swell, crack or scale.

Portland Cement must be of some standard brand of American, German or English Portland Cement, such as "Atlas," "Lagerdorfer," "Hercules," "Germania," "Dyckerhoff," etc. Slag cements and Belgian cements will not be accepted.

Natural cement must be Louisville Black Diamond or equal.

3. *Tests*—No cement will be accepted which cannot stand the following tests:

Portland Cement, not less than 95 per cent to pass through a 50 mesh sieve; initial set in not less than 45 minutes; tensile

strength neat, one day, 125 pounds; seven days, neat, 375 pounds; three parts sand, 125 pounds.

Natural cement, not less than 85 per cent to pass through a 50 mesh sieve; initial set in not less than 15 minutes; tensile strength neat, one day, 60 pounds; seven days, neat, 100 pounds; two parts sand, 50 pounds.

4. *Samples*—Each bidder will furnish a sample of each of the brands of cement which he proposes to furnish, to be selected from any barrel in his stock by the Engineer in Charge. This sample will be tested by the Engineer in Charge, and all the cement furnished under this contract must at least be equal sample; the judgment of the Engineer in Charge to be final on this point.

5. *Cooperage*—The cement must be delivered in substantial barrels ,lined with paper. The bidder will state in his bid the weight of the barrels he proposes to furnish.

6. *Time*—The cement must be delivered between the 20th and the 31st of the current month.

7. *Delivery*—To be made in lots of 1,000 barrels f. o. b. barge at New Orleans, Natchex or Vicksburg. The cement to be used about 40 miles above Natchez.

8. *Inspection*—The cement will be inspected and tested on delivery.

9. *Payment*—To be made when the cement has been delivered and accepted.

10. *Awards*—In determining who is the lowest bidder, the efficiency of the cement for the special work to be done will be considered as well as the price bid, the point of delivery and the size of the barrels. The judgment of the Engineer in Charge will be final on this point.

POSTER AND CIRCULAR LETTER.

OFFICE U. S. ENGINEER, Custom House,
New Orleans, La., August 8, 1899.

Ten days public notice.

M.....

.....

SIR—Sealed proposals submitted on the form below, marked on envelope "Proposal for Cement, Tile, etc., Ft. St. Philip," will be received at this office until 12 o'clock noon, August 18, 1899, and then publicly opened for furnishing and delivering to U. S. Engineer, Fort St. Philip, La., Cement, Tile, etc.

All articles must be the best of the kinds specified, and must be delivered at Fort St. Philip, La., free of cost of transportation to the Government, and within 10 days after receipt of notice of acceptance of bid.

The right is reserved to reject any or all bids.

CEMENT:

Portland Cement—This must be of first-class, uniform quality, thoroughly calcined, finely ground, so that at least 95 per cent will pass through a No. 50 sieve, and 80 per cent through a No. 100 sieve. Briquettes made of neat cement, kept 1 day in air and 6 days in water, shall have a tensile strength of 400 pounds, and when made into mortar, 1 part cement to 3 parts river sand, shall have a tensile strength of 200 pounds at end of 7th day, 1 day in air, 6 days immersed in water, the temperature of water not to be less than 40 degrees, or above the natural temperature at the locality where tests are made.

American Portland—This must be of first-class, uniform quality, thoroughly calcined, finely ground, so that at least 95 per cent will pass through a No. 50 sieve, and 80 per cent through a No. 100 sieve. Briquettes made of neat cement, kept 1 day in air and 6 days in water, shall have a tensile strength of 400 pounds, and when made into mortar, 1 part cement to 3 parts river sand, shall have a tensile strength of 200 pounds at end of 7th day, 1 day in air, 6 days immersed in water, the temperature of water not to

be less than 40 degrees, or above the natural temperature at the locality where tests are made.

American Portland—This must be of first-class, uniform quality, finely ground, so that 95 per cent shall pass through a No. 50 sieve, and 80 per cent through a No. 100 sieve. It must have a tensile strength of at least 200 pounds per square inch section when mixed, neat, and kept 1 day in air and 6 days in water, and not less than 125 pounds tensile strength when made into mortar, 1 part cement, 3 parts river sand, at the end of 7th day, 1 day in air, 6 days in water, the temperature of water not to be less than 40 degrees, or above the natural temperature at the locality where the tests are made.

Any cement that cracks or checks when made into thin cakes, or that, when made into soft mortar sets hard enough within 30 minutes to bear a weight of 1 pound on a wire 1-24 inch diameter, or which fails to bear the wire at he end of three hours, will not be accepted.

All cement must be delivered in well made, paper-lined barrels, not mutilated, so as to occasion loss in handling or risk in storing. It shall be in a floury condition, free from lumps, when delivered. It will be tested after delivery and all cement which does not conform to the requirements must be removed at contractors' expense and re placed by satisfactory cement without delay.

Since there is considerable difference in the weights of cement purchased in barrels, the bid will be based upon weight of cement, or so much per ton of 2,000 pounds, exclusive of weight of barrels:

POSTER AND CIRCULAR LETTER.

Ten days public notice.

UNITED STATES ENGINEER OFFICE, Room "N," Custom House.

New Orleans, La., June 23, 1900.

M.....

.....

SIR—Sealed proposals, submitted on the form below, inclosed in an envelope marked "*Proposals for Cement,*" will be received

3, 1900, and then publicly opened,
ment at Fort St. Philip, La., as per

SPECIFICATIONS:

levee at Fort St. Philip, La., at a
e officer in charge, free of cost of
ment, and within fifteen (15) days
ance of bid.
crease or to diminish the quantity re-
cent, and to reject any and all bids.
equal to "Atlas" cement and finely
shall pass through a No. 50 sieve and
100 sieve.
ength of, at least, 500 pounds per square
and kept 1 day in air and 6 days in
pounds tensile strength when made
and 3 parts river sand when kept 1 day
the temperature of the water to be not
above the natural temperature at he loca-
made.
checks when made into thin cakes or
mortar sets hard enough within 30 min-
pound on a wire 1-24 of an inch in
covered.
covered in well made paper lined barrels,
occasion loss or difficulty in handling.
solution and free from lumps when de-

EXHIBIT "G."

LIST OF PAPERS.

1.—Extracts from minutes of Drainage Commission, with dates.
2.—Report on Drainage by Advisory Board.
3.—General Specifications.
4.—Special specifications.
5.—Questions concerning the use of cement—with date.
6.—Report of Special Committee and Statement of Chief Engineer on change of cement.
7.—Additional statement of Chief Engineer on same.
8.—Original Specifications for Imported Portland cement.
9.—Supplementary and additional specifications for cement.
10.—Test of old briquettes of Steel Portland cement.
11.—Mr. L. W. Brown's letter.
12.—Report of Messrs. Hering and Richardson.
13.—Extract from report of Board of Experts.
14.—Statement for public by Executive Committee of Drainage Commission and Chief Engineer.

EXTRACTS FROM MINUTES

OF THE

DRAINAGE COMMISSION OF NEW ORLEANS.

Regular Meeting, February 13th, 1902.

* * * * * * * * *

Communication from Chief Engineer Harrod as follows:

NEW ORLEANS, February 10, 1902.

"Mr. R. M. Walmsley, President,
The Drainage Commission of New Orleans, City.

"Sir—I have the honor to suggest, through you to the Drainage

Commission, that Mr. H. B. Richardson and Mr. Rudolph Hering be requested to make examination and report on the manner, both as regards design and construction, in which the plan of drainage has so far been carried out, and on any other matters which appear to them to bear on the subject. You will recollect hat these Engineers, with myself, composed the Engineering Committee of the Advisory Board, under whose examination and approval the plan was prepared.

Very respectfully,
(Signed) "B. M. HARROD,
"Chief Engineer."

* * * * * * * * *

"President Walmsley then said that Major Harrod had requested that Messrs. Hering and Richardson investigate the charges made by L. W. Brown that the plan of drainage had not been carried out. Mr. Brown said that he plans had been annihilated. This is a most remarkable statement. If the plans had been annihilated, the Board should know it. If they had been carried out, the Board and the public should know it. Mr. Richardson is here and Mr. Hering could be reached. Major Harrod had reported to the Board from time to time that he plans had been carried out, with the exception of minor changes. Mr. Walmsley then read part of Section 4, Act No. 114 of 1896, as follows: "Be it further enacted, etc., That said Commission shall have full power to control and execute the drainage of the City of New Orleans, and may proceed to execute and carry out substantially the plan for such drainage adopted by the Council of said City by Ordinance 10,991, C. S., approved July 10th, 1895, so far as it may find said plan desirable and practicable, with the right, however, to modify the same as in its judgment circumstances may require.' Major Harrod was selected by the Board as Chief Engineer because of his recognized ability, high character and reputation as an Engineer, and the Board has reposed full confidence in him. It is due Major Harrod to say that his resignation has been rendered to the Board, to be exercised by the Board at its discretion. The Engineer's office is necessarily complicated, being one of great detail, and no doubt would require some time to put it in shape to turn over to a successor.

"It was moved by Mr. Morris, seconded by Mr. Cucullu, that the President arrange with Messrs. H. B. Richardson and R. Hering to examine, both as regards design and construction of the drainage system thus far carried out, and also as to the character of the work performed and report as soon as possible to the Board. The expenses incurred in the examination to be borne by the Commission."

* * * * * * * * *

"A general discussion then followed on the prices of cement. It was moved by Mayor Capdevielle that the Chief Engineer ascertain the price of the different cements used in the drainage work during the years 1897 and 1899, and report same to the Board for the purpose of using same as evidence in a suit to be filed by the Counsel of the Commission."

* * * * * * * * *

QUESTIONS CONCERNING THE USE OF CEMENT.

(1) Do not the specifications for the recent drainage contracts require the use of foreign Portland cement?

(2) Have they been modified by you or the board, and to what extent?

(3) Is not there a difference of about sixty cents per barrel between the foreign and the domestic Portland cement?

(4) How does the contractor make the rebate and in what amount, in being permitted to use the domestic Portland?

(5) Are the companies using the American cement, which is as good as the imported?

(6) Why was the foreign Portland named in the specifications and after the bids were awarded, the use of the American permitted?

(7) Did the National Contracting Company save one hundred thousand dollars on its contract by being permitted to use American cement after bidding for the imported cement; if so, what did the National Contracting Company give the Drainage Board as a rebate?

(Submitted January 28th, 1902.)

Report of Special Committee and Statement of Chief Engineer, concerning cement:

February 15, 1902.

In calling the meeting to order, R. M. Walmsley, president of the board, said:

"On Friday last, through Mayor Paul Capdevielle, I was informed for the first time that it was rumored that in contracts of this commission with the National Contracting Company and others, that cement other than that specified in the contracts had to some extent been allowed to be used without the authority of this board, and as it appeared that prompt and thorough investigation should be had, on Saturday last I took the responsibility of appointing a committee to investigate the charge.

"That committee is now ready to report. It occurs to me that the first action of this board should be to confirm the action of the president in appointing this committee."

The action of the president was confirmed and the committee, which was composed of Louis Cucullu, James McRacken and C. T. Yenni, submitted the following report:

"We, the undersigned committee, appointed for the purpose of investigating the rumors that cheaper grades of cement than called for in the specifications have been substituted in past and present contracts, wthout a corresponding rebate to the Commission, thereby largely increasing the profits of the contractors, without any benefit whatever to the Commission, we respectfully report, after due investigation, as follows:

"In contracts 'A' and 'C,' which were awarded to the National Contracting Company on Aug. 9, 1897, and merged into one contract, and in contract 'F,' awarded to C. F. Collom & Co. July 28, 1899, the specifications called for the use of American Cement on certain portions of the work and imported Portland Cement on other portions.

"After the acceptance of the bids of the National Contracting Company and Messrs. C. F. Collom & Co., we find that Major Harrod, our chief engineer, drew up supplemental specifications, affecting the cement to be used, providing for tests, etc., authority for which, the engineer claims, was vested in him by the original specifications.

"The estimated aggregate number of barrels of imported Portland Cement which the specifications called for, and which were

permitted to be substituted by American Cement under the supplemental specifications, was forty-nine thousand, two hundred and twenty-one barrels (49,221).

"The difference in the price of cement used, which is admitted by the engineer to have been cheaper than that called for in the specifications, has not been ascertained by your committee, owing to the very short time that this matter has been under investigation. But whatever the difference may have been, the Drainage Commission has not been a beneficiary in any amount.

"The substitution was not made with the approval of the Commission, as the engineer failed to officially notify the Commission of the substitution by the amended specifications, and therefore not obtaining the Commission's ratification of the change, the engineer made a very serious error.

"The specifications for contracts awarded in July, 1901, to the National Contracting Company, United States Construction Company and Messrs. Nash & Dowdle and John McCoy, which also called for the use of imported Portland Cement on certain portions of the work, have also been modified after correspondence with the various contractors to permit the use of certain standard brands of American Portland Cement, in lieu of the imported article, but same is being done with the approval of the Commission, which is being benefited in the reduced cost of construction to an amount of not less than ten thousand dollars ($10,000.)

"We respectfully close our report with the suggestion that our chief engineer be requested to make a full and lucid statement of the circumstances under which the substitutions were permitted by him."

Major B. M. Harrod, the chief engineer of the board, then submitted his report on the matter, which was as follows:

"In obedience to the request, contained in the report of your committee, I beg leave to submit the following statement:

"The general specifications adopted by the City Council in 1896 were vague concerning the quality of cement to be used, the properties required and the tests to be exacted. In the case of imported Portland cement, it was only required that 95 per cent should pass through a 2500 mesh sieve, and that a seven-day neat test should give a tensile strength of 400 pounds per square inch.

"The special specifications for the contracts of 1897 with the National Contracting Company, and of 1899 with C. F. Collom & Co., added nothing to these requirements beyond calling for bids on the following items:

"Contract 'A'—National Contracting Company—Central power and pumping stations and lined and covered canals.

"Brickwork—American Natural Cement—1 of cement, 2 of sand.

"Imported Portland Cement—1 of cement, 2 of sand.

"Imported Portland Cement—1 of cement, 3 of sand.

"Concrete—American Natural Cement—1 of cement, 2 of sand.

"Imported Portland Cement—1 of cement, 2 of sand.

"Imported Portland Cement—1 of cement, 3 of sand.

"Contract 'F'—C. F. Collom & Co.—Lined and covered canals.

"Brickwork—American natural Cement—1 of cement, 2 of sand.

"Portland Cement—1 of cement, 3 of sand.

"Concrete—American Natural Cement—1 of cement, 2 of sand.

"Imported Portland Cement—1 of cement, 3 of sand.

"Surfacing—Portland Cement—1 of cement, 1 of sand.

"These contracts afford the only instances where steel Portland has been used in the place of imported Portland cement, and in each case it is left undetermined in the specifications, and presumably at the discretion of the engineer in what part of the work the different material bid for should be used.

"Subsequent to the adjudication of these contracts, application was made by the contractors to be allowed to use steel Portland cement, and American product, where the bid had been for imported Portland. Additional conditions, both physical and chemical, were then atached to the specifications, and the contractors were informed that if that cement complied with the higher or more detailed tests its use would be allowed. The additions to the specifications required much finer grinding, certain tensile strength at different periods, and when mixed in different proportions chemical analyses and other examinations. The material used under this agreement was under constant test at Tulane University, and its acceptance or rejection was determined by these tests, as was also the work in which it was used.

"The advantages which may have accrued to these contractors from the use of a cheaper cement than was specified may be esti-

mated in the following manner. The measurements for final estimates for payment on the part of these two contracts where steel Portland instead of imported Portland cement was used were as follows:

	Cubic Yds. Brickwork.	Cubic Yds. Concrete.
National Contracting Co.	46,099	33,109
C. F. Collom & Co.		4,842
	46,099	37,951

"Under the contracts let in 1901, propositions were received from the contractors to use steel Portland instead of the other grades of American Portland cement, at a reduction of 18 cents per cubic yard of brickwork, and also to use these other brands of American Portland instead of imported Portland cement, at a reduced price of 8 cents per cubic yard. The steel Portland could, therefore, be used in brickwork for 26 cents less per cubic yard than the imported Portland cement. The difference in concrete would be about twice this amount, or 52 cents per cubic yard. Applying these prices to the quantities given above gives a difference in favor of the contractor of $31,720. 26. This is the difference as it existed last year, based on propositions of the contractors. I have no information whether it would have been more or less in 1897.

"The price at which steel Portland cement could be obtained, allowed the contractors a larger profit than there was in the use of imported Portland, but the tests under which it was used were more complete and exacting than those which were provided in the general and special specifications under which the bids were made, and the material proved satisfactory under these tests and in the work.

"I recognize the justice of the censure conveyed in the report of your committee in regard to this transaction as an error, inasmuch as better terms might have been exacted from the contractor, and as it should have been referred to the commission for its sanction.

"In subsequent contracts, those of July, 1901, with the United States Construction Company, for pumping station No. 3; with

the National Contracting Company for the Third street and St. Bernard lined and covered canals; with Nash & Dowdle for the Nashville and Lowerline lined and covered canals, and with John McCoy for the Algiers lined and covered canals, the specifications called for bids on Portland cement; for concrete on American natural and on imported Portland cements, and for surfacing on Portland cement.

"In order to secure uniformity in the bids and make them readily comparable, one with another, contractors were advised to base their bids on imported Portland, complying with a special specification of qualities and tests. Propositions were received subsequent to adjudication for the use of American Portland cements, at a fixed rebate in favor of the Drainage Commission, provided that they fully complied with the specifications for imported Portland. The arrangements based on these propositions are now in effect, and estimates and payments are made at the reduced rates. Tests are regularly made at Tulane University, which determine their acceptance or rejection. The brands which contractors have chosen to offer are the 'Atlas,' 'Universal' and 'Vulcanite.' They have been faithfully sampled and tested with satisfactory results.

"The papers and correspondence on which this statement is based are part of the records of this office."

COPY OF ORIGINAL SPECIFICATIONS FOR IMPORTED PORTLAND CEMENT.

L. P. 97. This cement shall be of the best quality of hydraulic Portland, and the average gross weight per barrel shall not be less than 400 pounds. At least 95 per cent, by weight, shall pass through a sieve with 2500 meshes to the square inch. It shall have a tensile strength of at least 400 pounds to the sqaure inch, when mixed neat and exposed one day in air and six days in water.

SPECIFICATIONS FOR PORTLAND CEMENT, FOR USE IN CONNECTION WITH WORK—NEW ORLEANS DRAINAGE COMMISSION.

The cement shall be of the best quality of Seel Portland, and the average net weight per barrel shall not be less than three hundred

and thirty-five (335) pounds. At least ninety (90) per cent, by weight, shall pass through a sieve of 40,000 meshes to the square inch.

A cement that cracks or checks when made into thin cakes, or that, when made into soft mortar, sets hard enough in less than thirty (30) minutes to bear a weight on one pound on a wire 1-24 inch in diameter, will not be accepted.

All tests of cements shall be made at or above a temperature of sixty (60) degrees Fahrenheit. Samples for testing may be taken from ten barrrls of every lot of fifty barrels, and these samples shall be thoroughly mixed and made into briquettes, and, if the average strength of the ten briquettes is below that required, or if any two briquettes are ten (10) per cent below the required strength, it shall be sufficient cause for rejection of all the barrels in the same lot from which the samples were taken.

Tests will be made with cement mixed neat, and also with three parts of sand to one of cement, and briquettes of each ten barrel samples, will be exposed one day in air and six days in water, and one day in air and twent-seven in water before they are tested.

Cements must correspond with labels on their barrels or sacks, in composition, weight, maker and place of manufacture. Bills of lading must be furnished, if required.

No cements that are known to be adulterated cements, shall be presented for testing. No adulterated cements will be allowed Portland cements, when analyzed, must be within the following limits:

Silica	20 to 29 per cent.
Alumina, plus oxide iron	5 to 13 per cent.
Lime	50 to 65 per cent.
Magnesia	0 to 3 per cent.
Sulphuric acid	0 to 1½ per cent.

The presence of unhydrated, or under-burnt lime, or sulphuric acid, or magnesia, in quantities sufficient o be dangerous to the future soundness of the cement, will be cause for rejection.

No over-limed or non-uniformly ground cement will be allowed. Hot and cold tests will be made for soundness.

Gilmore's needles will be used for testing set. Specific gravity and chemical analysis will be made, for detection of adulteration or under-burning.

Portland cement must show the following tensile strength, in pounds, per square inch, when tested in accordance with the Am. Soc. Civil Engineers' Rules. Spalding on hydraulic cement, will be used as authority.

	Neat.	Sand 1:3.
Seven days	400	125
Twenty-eight days	500	175

Tests will be made by Prof. W. H. P. Creighton, of the Tulane Testing Laboratory, and the acceptance or rejection of material will be determined by these tests.

ENGINEER.

POUNDS PER SQUARE INCH.

BRAND.	1 TO 3 STANDARD QUARTS SAND.					REMARKS.
	1 *year.*	24 *hrs.*	7 *days.*	28 *days.*	3 *mos.*	6 *mos.*	1 *year.*	
Garden City								
"								
"			104	285				
Dominion			145	258	303	326		
"			150	264	321	330		
Chicago			115	298	376	396		
"			189	300	406	386		
Fort Scott			58	152	196	210		
Vulcanite			152	268	308	319		
Alpha			175	293	317	336		
Porta			116	289	345	322		
Kaiser			130	260	325	360		
Belgian			85	130	219	219		
American A. A.			150	262	376	346		
German			164	285	379	384		
Royal Crown			99	160	261	305		
Bolt			130	198	291	299		
Hemmoor			186	261	305	330		
Atlas			223	370	426	428		
Eagle			105	210	326	331		
Brier Hill			100	163	276	302		
Lehigh			198	330	376	379		
"			118	295				
Iola			173	250	301	298		
"			189	215	327	330		
"			185	240	308	360		
"			230	289	359			
"			160	275				
Minerva			110	216				Very Coarse and Irregular
"					226			
Hoxter								
Royal								
Hercules								
"			270	334	330			
Giant			104	326	329	319		
Improved Union			70	120	210	289		
Union			70	110				
Texas			168	253	362	371		
Star			210	319	328	331		
Universal			207	329	332	335		
Dania			200	292	309			
Paragon			156	213	290			
Unknown			233	303	348			
Steel			214	270	280			
Kenmark			152	238	328			
Royal Eagle			184	219	250			

Results are

W. J. HARDEE,

CITY ENGINEER.

LETTER OF MR. L. W. BROWN TO "TIMES-DEMOCRAT"—FEBRUARY 8th, 1902—CONCERNING CEMENT.

NEW ORLEANS, FEB. 8, 1902.

To the Editor of The Times-Democrat:

The statement from the National Contracting Company, published in your columns of yesterday, referring to the exposure in connection with the drainage work, merits a statement from me, for the reason that the drainage work of this city has been and still is a matter of great professional moment to me, and I am interested in securing to this city the greatest possible benefits therefrom.

As a matter of fact, I am professionally identified with the work throughout the engineering world, having spent much time and labor between the years 1886 and 1896 in making investigations and working out and designing the plan of 1896, and have since recorded in the engineering world a very considerable amount of literature on the subject. The long study I have given the matter has necessarily made me familiar with every detail, and I have viewed with considerable anxiety the methods which have been adopted in the execution of the work, especially when they affected, as has been the case, the integrity of the structures and the efficiency of the system as contemplated by the plans of 1896. I have on several occasions pointed out that the work as now being executed was in direct violation of the plans of drainage as adopted by the City Council in 1896 and later approved by the State Legislature, and that, in my opinion, the eminent success of the result as contemplated would be very materially modified.

As is generally known, when I had completed the plans in 1896 I was retired from active charge of the work, and was engaged for two years by the National Contracting Company, but since 1899 I have had no direct connection with the work.

In all the work I have done for the drainage of this city, even when employed by the National Contracting Company, I have endeavored to secure the best possible results to the city from the work, and have on many occasions, even while acting as the contractor's engineer, taken occasion to widely differ with the chief

engineer of the Drainage Board relative to the methods which were adopted, and in many instances my differences were recorded in a communication; but to not one of my many protests has any attention been given, and I am constrained to now record that the drainage system of 1896 is practically annihilated, both as to stability and efficiency; and to further record that if the chief engineer be called upon to describe the engineering features, advantages and value of the system as it now exists, he would be unable to do so, as the many changes have destroyed all the value of the fundamental formula of the system of 1896.

As to the original specifications for the work, which were prepared with extraordinary care, and which have received the commendation of some of the ablest engineers of the country, under the interpretation of a careful and competent engineer, it would be impossible to secure other than satisfactory results, and the contractor could secure no advantage were they strictly adhered to.

As to the use of Utica and other natural cement, I have repeatedly expressed myself to the chief engineer of the Drainage Commission and to others to the effect that, in my opinion, it is most ridiculously absurd and a violation of proper engineering usages to use natural cement in the retaining walls of work, such as forms the large conduits of the drainage system, when the work should be expected to last 200 years or longer, and in my opinion the question of money saved by the use of a natural cement over that of a high grade artificial cement for work of this class is but a small matter as compared with the value of the stability of these expensive and constantly needed structures, and, as I have often remarked, the difference in cost of a high grade artificial cement would not exceed $100,000 for the whole of the work over the cost of natural cement, and the advantages would be inestimable. Several thousands of dollars have been expended by the Drainage Board for the testing of cement, and it would appear that this sum should have included some good advice as to the quality of cement proper to be used in this important work. And, again, several thousands of dollars have been recently expended for expert engineering advice in connection with the drainage work, and it is to be regretted that an opinion should not have been expressed as to the stability and longevity of the structures they examined; and it

is further to be regretted that any conditions should have arisen requiring this expensive expert examination.

The explanation of the National Contracting Company as to the cement they used must necessarily be extended further than is implied by the statement published yesterday, as I personally took no part whatever in any transactions relative to cement, either in negotiations with the Drainage Commission as to quality or for the purchase of same. Respectfully,

L. W. BROWN.

NEW ORLEANS, LA., MAY 14th, 1898.

Major B. M. Harrod, Chief Engineer:

DEAR SIR—At your request we have examined the work, and considered the design for the construction of the St. Louis Canal.

The use of piling or other support to the foundations was originally considered as a possible necessity, though it was deemed advisable to begin construction without them. The bearing power of the soil at the depth where the foundations of the wall rest is now found to be insufficient for the weight imposed. We therefore think piles should be used until the conditions are improved.

The transverse slope of the bottom is too great to be safe in the soil found at that depth.

As regards the efficiency of the system, we believe it to be quite safe to reduce that slope to one on four, leaving the foot of the walls at the elevation as at present constructed. The capacity of the Canal would then still be equal to that provided for the pumps at Station No. 2. Respectfully,

(Signed) RUDOLPH HERING,
HENRY B. RICHARDSON.

The following is an extract from the Report (dated June 13th, 1901) of the Board of Experts, appointed by the Drainage Commission to investigate the drainage work:

* * * * * * *

"The general character of the work which has been executed by the National Contracting Company is of undoubted excellence."

"The canals, as a whole, are substantially founded and built; they have clean, smooth sides and well lined bottoms, while the I-beams and arches form a thoroughly good covering which is holding perfectly, and even the effect of corrosion, which was most to be feared on the I-beams, appeared very slight on the uncleaned beams, which we have examined. On Canal Street, we found the canal bottom perfectly clean, with about 8 inches of water flowing through it at a very high velocity, sufficient to keep it thoroughly scoured out. On Camp Street, the current is checked by the existence of a 30-inch water main which closes up nearly the whole area of the canal at Camp and Canal, greatly impeding the flow, and causing serious deposit in this canal which will be undoubtedly carried away when this obstruction is removed."

"On St. Louis Street, the canal was about half full of water and had a considerable amount of mud in its bottom. While we were in the canal at this point, pumping was commenced at Station No. 2, as we understood it, with one pump. This at once started the flow, at a velocity of about 1½ feet per second, which, while not sufficient to scour out the existing deposit, showed conclusively that with the three effective pumps called for the contract at No. 2, the velocity and discharge capacity of this canal would be immense and any deposit in it would be thoroughly removed."

"At all of the pumping stations, and the central power plant, we found neatly designed and substantially built brick buildings, altogether free from any indication of cracks or settlement, showing secure foundation and admirable workmanship. Inside of these buildings, aside from the mostly minor omissions, faults, and defects, which are practically all covered in the bill of particulars included in the report of your Chief Engineer, the whole equipment of these plants seems to be thoroughly good."

(Signed) H. J. MALOCHEE,
T. H. TUTWILER,
GEO. G. EARL.

STATEMENT FOR PUBLIC BY EXECUTIVE COMMITTEE AND CHIEF ENGINEER—SEPTEMBER 4, 1901—IN ANSWER TO REQUEST FROM PROGRESSIVE UNION.

NEW ORLEANS, LA., AUG. 28, 1901.

In November, 1893, an Advisory Board was established by Ordinance No. 8327, C. S., to recommend a plan for the drainage of the City of New Orleans.

This board in April, 1895, submitted, with its recommendation, a plan prepared by the city engineer under the examination and approval of its engineering committee.

In July of the same year the City Council approved this plan by the passage of Ordinance No. 10,091, C. S.

In July, 1896, the General Assembly of Louisiana, by Act No. 114, established the Drainage Commission of New Orleans with "full power to control and execute the drainage of the City of New Orleans and to proceed to execute and carry out substantially the plan of such drainage, adopted by the Council of said city by Ordinance No. 10,091, C. S., approved July 10, 1895, so far as it may find said plan desirable and practicable, with the right, however, to modify the same as, in its judgment, circumstances may require."

The general features of the plan have been repeatedly presented by publication and discussion. It may be well, however, to repeat them now in condensed form.

The drainage limits, on the left bank, extended from the river to the lake, and from the upper line of the city to the lower boundary of the lower protection levee, Florida walk and People's avenue. On the right bank they extended from the upper line of the Fifth Municipal District to the lower line of the United States naval reservation.

For convenience the area was divided into six sections, all on the left bank, except the last, or Algiers section. Those on the left bank were consecutively numbered from above downward, and all excepting the fifth extended from the river to the lake. The fifth has Florida walk as its rear boundary.

Lake Borgne was chosen as the main outfall, and the plan contemplates its use for this purpose to an extent only limited by the economical and efficient construction of canals and pumping stations. At the same time it was recognized that, under certain conditions of local rainfall, the runoff was so great and sudden that it would be impossible to dispose of it along a single line, and, therefore, for such occasions, relief outfalls into Lake Pontchartrain were provided.

To carry out these intentions a main canal was designed, running through the lowest levels of the drainage area, along the middle of the first four sections and forming the rear boundary of the fifth, mainly following Broad street and Florida walk. It was to be connected with Bayou Bienvenu, an affluent of Lake Borgne, by the main outfall canal.

All drainage was to be collected into this main artery, from both lake and river sides, by gravity. But as this great drain was located on the lowest ground, not above the level of the outfalls in Lakes Borgne and Pontchartrain, it was necessary to give velocity to the water reaching it by creating an artificial fall. This was done by the location of pumping stations at suitable intervals along the main trunk drain, and other outlying ones, for the emergencies of great storms, as before mentioned, on relief canals leading to Lake Pontchartrain.

BRANCH CANALS AND DRAINS.

The features of the plan relating to the proposed branch canals and drains for the local collection of drainage and its delivery into the main trunk in Broad street, are described in the following extract from the report of the Advisory Board:

"The plan proposed, and for which estimates are furnished, includes the lining of the sides and bottoms of most of the canals and drains and the covering of the smaller ones between Broad street and the river. Eventually, nearly all of the drains and canals will require similar permanent lining, but for a long time this necessity will not exist.

"In general, all canals, branches and drains between the river and the main canal should be lined with masonry, and many of them covered with the street pavements, but those between the

main canal and the lake may be left without lining for years to come.

"Canals and drains between the main canal and the river should, in general, be lined as they are built, though the covering may be omitted. In some cases, where they occupy narrow streets, the absence of covering would result in considerable public inconvenience, which could not long be tolerated. It would, therefore, appear proper to prosecute the work on most of the canals and other conduits between Broad street and river under specifications requiring them to be lined and covered, and the estimates hereinafter presented contemplate such lining, except in certain specified cases, and the covering of all drains between Claiborne street and the river, with certain others mentioned.

In closing its report the Advisory Board recommended an order of procedure to be followed in construction in the second section, or that between the river and lake, Julia street and the New Canal on the upper, and Carondelet Walk and the Old Canal, and Bayou St. John on the lower side, the most populous and valuable part of the city This order was as follows:

"1. The construction of pumping stations Nos. 2 and 7, with the improvement of the relief branch canal connecting these stations.

"2. The construction of the St. Louis branch canal, with lining and covering.

"3. The main branch drains between Broad street and the river to be lined and covered.

"4. The improvement of street grades and gutters.

"5. The improvement of the Orleans relief outfall canal.

"6. The construction of main and branch drains between Broad street and the lake.

"7. The construction of the main canal and its connections with the sections above and below.

"The work on other sections may be prosecuted in any order, or at any time, as it may be found most convenient."

It is presumable, however, that the same principles which make this order of work proper in the second section are generally applicable to the others, unless special reasons for exceptions should appear.

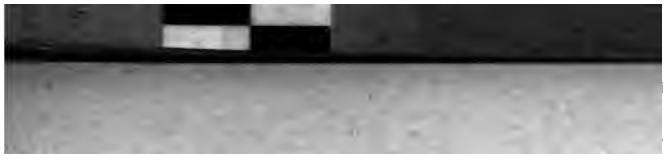
It was the intention of the Advisory Board to use all existing canals or other available work, as far as practicable.

The Drainage Commission, having organized in 1896, under the authority above cited, proceeded to carry out the plan of drainage adopted by the City Council and State Legislature. They properly conceived that the improvement of the second section, the commercial centre, and the most populous and valuable part of the city, should first receive attention. Therefore, in compliance with the adopted plan, they advertised for bids for the construction of the Central Power and Pumping Stations Nos. 2 and 7, with the improvement of the relief branch canal connecting these stations; for the St. Louis branch canal with lining and covering; for the main and branch drains between Broad street and the river, lined and covered; and for the improvement of the Orleans relief outfall canal, all being essential parts of the drainage of this section. The contract for this work was let in August, 1897. Together with these works, and included in the same contract, were Pumping Station No. 6, with its outfall canals, and the enlargement of the unlined canals leading to this station from the low lands of the first section in front of the Metairie Ridge. It is submitted that this work was an application to the first of the same order of procedure imposed by the plan on the second section, and quite justified by existing conditions.

SEVENTEENTH STREET CANAL.

Simultaneously with this work, the Seventeenth Street Canal was being excavated. Although this was a part of the adopted plan, its execution at this early time was forced on the Commission by an Act of the Legislature at the session of 1896, directing the closing of the Louque cut, through which the Melpomene tail-race had its outfall into the New Basin Canal. The closing of the cut now transfers the drainage through the Seventeenth Street Canal to Pumping Station No. 6.

In September, 1898, the Drainage Commission awarded contracts for the excavation of the Florida Walk, Lafayette, Jourdan Avenue and the Claiborne extension canals. All this work was part of the adopted plan. The first mentioned (Florida Walk Canal) was a section of the main trunk heretofore described as



designed for the Lake Borgne outfall. This work was further considered advisable as giving to this lower section a measure of improvement similar to that which had already been inaugurated in the first section.

Following this, and under contract of May, 1899, the main outfall canal, leading from Jourdan Avenue Pumping Station to the head waters of Bayou Bienvenu, was excavated. The work was not only part of the adopted plan, but also of the main trunk canal, and was required at this time to abate complaint of overflow of lands below and on the Gentilly Ridge caused by the operation of the Jourdan Avenue Pumping Station.

Additional contracts were let in July, 1899, for the lower half of the Third street system of lined and covered canals, for pumping station No. 1, and for the open canals connecting these lined canals with the station; thus following in this section the order of procedure advised in the plan, and already applied in the Second, as pumping stations Nos. 1 and 6 bear the same relation to one another as do Nos. 2 and 7 in the Second. The extent of work was limited by the funds available at the time. At the same time the Algiers pumping station was built, and half of the steam plant was transferred from the Jourdan avenue to that station. This was replaced at the Jourdan station by an electrical motor equipment.

During the month of July of the present year contracts were let for the completion of the upper half of the Third street system of lined and covered canals; for the St. Bernard system of canals and pumping station No. 3, to which they are tributary; for the Nashville and Upperline systems of canals, both tributary to pumping stations Nos. 1 and 6; and for the Algiers system of canals. All this work was in conformity with the adopted plan and its order of execution.

This enumeration of the works undertaken up to this time is given as briefly as possible, and without comment, to establish the fact that the Drainage Commission have been guided in all their proceedings—

1. By the adopted plan of drainage.
2. By the order of procedure in work forming part of that plan.
3. By the distribution of work that would, as far as practicable,

be just to the settled and improved parts of each of the drainage sections.

It will be seen that extremely limited use has been made of the latitude of change granted them by the original law, and that the lines and order of development of the adopted plan have been closely followed.

Any order of work that might have been adopted would have involved hardships to some localities and have aroused complaints more or less reasonable.

IMPATIENT LAND SPECULATORS.

It is not unexpected or unnatural that those who have invested in swamp lands of speculative value between the Metairie Ridge and the lake should impatiently await the improvements that will enable them to realize. But it did not appeal, as a business proposition, to those who prepared or those who adopted the present plan that theses wamps should be drained before a very substantial measure of relief had been given to parts of the city with a dense population and fixed values. For this reason "the construction of the main and branch drains between Broad street and the lake" was put sixth on the list, or next to the last of the works in order of execution. The Drainage Commission takes the same view. But this affords absolutely no grounds for the imputation that this part of the plan is abandoned, and this opportunity is used to deny any such statement. The importance of this part of the work is recognized, but it is relatively small when compared to the needs of more improved sections.

A like denial is made of the assumption that the main trunk canal, with an outfall to Lake Borgne, is abandoned. On the contrary, it is regarded as a most necessary part of the plan. This statement is supported by the fact that two sections of it, viz: from Elysian Fields to Jourdan Avenue, and the main outfall, have already been built. But it is true that the construction of other parts of the general plan will give earlier relief. The Advisory Board understood this, and for this reason placed this great canal seventh or last in the order of construction—not because it was of least importance, but because the system could be made operative,

although incomplete, without it, and more prompt relief could be thus given.

It is a sound proposition that in the application of any sanitary improvement to a city the first consideration should be given to those parts where business is transacted, where a dense population centres and where values are fixed and high. This is not less true if there is a doubt as to the sufficiency of available funds for the ultimate extension of the system to its projected limits.

The works just enumerated as having been placed under contract prior to the 24th of July of this year comprise a central power station, in which is installed boilers, engines, generators and auxiliary machinery capable of developing 3600-horse power. Also four electrically driven pumping stations, designed for a present aggregate delivery of 2790 cubic feet of water per second. An electric motor has also been attached to one of the pumps at Jourdan avenue. In all these stations, both power and pumping, provisions have been made for a large increase of capacity in the future, and Nos. 1 and 2 are arranged with special reference to operating through the main trunk canal, and the same is true of pumping station No. 3, which has just been placed under contract. Ten miles of power and telephone lines connect these stations one with another. There has also been built in Algiers a steam pumping plant with a capacity of 150 cubic feet of water per second.

The present installation in the Central Power Station was originally proportioned to the demands of the pumps erected in Stations Nos. 2, 6 and 7. By the erection of No. 1 and the connection with the Jourdan Avenue Station, its capacity is severely taxed, and on the completion of No. 3, now under contract, and the installation of an additional pump which is needed at No. 6, must be increased by additional boilers, engine and generator, capable of developing not less than 1333-horse power. This is solely necessary on account of the extension of the system. The power already installed has proved sufficient for its intended use, but not for the additional consumption contemplated.

In addition to this construction to power and pumping stations, there have been built 15½ miles of open and unlined canals; 7½ miles of lined and covered canals, and 65,472 square yards of asphalt and square block pavements.

Much work has also been done in the repair of the old drainage machines and the cleaning of old canals, which the city was unable to undertake.

All this work has been satisfactorily finished, except that included in the contracts with the National Contracting Company. The same may be said of the greater part of the work of this company.

The lined and covered canals have been constructed in a workmanlike manner of good material. The power and pumping stations are admirable structures of their kind, on foundations of extreme difficulty, but of perfect stability. The machinery for power and pumping contained in them is of a high character, barring those parts which are in contention and now in the hands of the Board of Arbitration, and of which the failure, up to this time, of the pumps in Station No. 2 may be instanced as the most notorious and inexcusable feature.

MATTERS IN CONTROVERSY.

The matters in controversy between the Drainage Commission and the National Contracting Company have been the subject of frequent demands on the part of the former, which, in many cases, have been disregarded by the latter. They have now been placed in the hands of a Board of Arbitrators, whose award will be reported to the commission, and, no doubt, will command the assent of both parties. This method of settlement, as well as the character of the men who have undertaken it, should command the confidence of the public as leading to more prompt and accurate decision than could be reached by the ordinary method of litigation. Under these circumstances, a discussion of the causes of differences is not now advisable, but the statement can be made that the sum of $167,000, which the commission has withheld and now holds, with the fixed intention to apply it to the completion of the work, is more than sufficient to cover the defaults of the Contracting Company.

In entering into engagements with the National Contracting Company, the Drainage Commission was aware of the magnitude and importance of all and the novelty of many parts of the work. The application of electricity was, under the circumstances, new,

but has been entirely successful. The pumps were the largest known in the world, but the centrifugals in Pumping Stations Nos. 6 and 7, notwithstanding the failure of the screw pumps at No. 2, successfully discharge the required volume at the required height.

The design and proportions of the pumps for Station No. 2 were, to a certain extent, new, but others of the same type have been successfully used elsewhere.

The screw pump has long been used for raising water, and is particularly efficient where the height to which the water is to be raised is comparatively small.

A form of screw has been used for many years in Holland, and there are numerous instances of its use in America. The largest, and possibly the most successful screw pump, is that in use in the Milwaukee Flushing Tunnel. The screw in this case has a diameter of 14 feet and a capacity of over 40,000 cubic feet per minute, or about three times that required by each of the large pumps at Station No. 2 in New Orleans. This pump is driven by a steam engine at a speed of about fifty revolutions per minute, and operates against a total lift of 3 feet.

This machine was installed in 1888, and has been in constant and highly successful operation since that date. On account of its success a second one, of greater lift, is now to be erected.

Two screw pumps were installed some years ago on the Mississippi River Commission's dredgeboat Alpha, one of these pumps having a capacity of 25 cubic feet per second, against 10 feet head, and the other a capacity of 10 cubic feet per second and 25 feet head. The latter gave satisfactory service until the boat was dismantled.

Another pump of this type has been installed at the plant of the Racine Water Company, capacity of the pump being 10,000,000 gallons per day, 25 feet lift.

In California screw pumps are very largely employed in pumping from artesian wells, the screws being arranged in series on a vertical shaft which is lowered into the well.

A similar pump is being installed in the new Cincinnati waterworks for pumping out the intake under the river.

Many of these have been erected by the E. P. Allis Company.

Although these pumps have here failed there is still reason why the statement that an 8-foot stream cannot pass through a hole 2 feet square should be received with some caution.

REASONABLE PRECAUTIONS TAKEN.

Under these circumstances the Drainage Commission may claim that it took reasonable precautions in selecting the proposals submitted, and in placing the work in the hands of the National Contracting Company, with the E. P. Allis and General Electric companies as their principal subcontractors. Each one of these companies are known over the entire country for skill and energy as contractors in their several departments, and for solvency as corporations.

The failure in the designs of the pumps for Station No. 2, and in some other matters now in controversy, and the contractor's gross delay and apathy in complying with demands for remedy, during three years, the reasonableness of which they have never questioned, has been a surprise and disappointment, not only to the Drainage Commission, but to the community. It is but just to say that the work of the General Electric Company has very generally satisfied the tests required of it.

The experience gained by the Drainage Commission during the progress of the work has led them to certain conclusions which, if applied in practice, would be of material advantage to the work. Some of these are inherited from the report of the Advisory Board, and others have been forced upon them by the observation of results. But, as is usual in corporate work, there are obstacles of a political or financial character which makes their application difficult. For instance, there is no doubt of the advantage of having canals on neutral ground streets lined but uncovered, with protection given to the public by surrounding iron railing. The reasons that make for this are both sanitary and economical, while the resulting aspect would not be unsightly. The thin coating of earth which can be back filled over the cover will afford most unsatisfactory soil for the growth of sod or shrubbery. But all propositions of this sort have been so strongly opposed by petitions that the commission has so far felt constrained to cover such canals in every instance. Again, there is no doubt but that every canal

should be lined, whether the conditions justify a cover or not. This is true even of the collecting and outfall canals between Metairie Ridge and Lake Pontchartrain. This would be immediately justified by the better results which would attend the operation of the pumps and by obviating the necessity of cleaning which unlined canals require from time to time, while in the distant future it would be even justified as a measure of economy. But the means of attaining this end are not now available, and did not form part of the recommendations and estimates of the Advisory Board. It surely would not be wise at the present time to extend their lining beyond the limit of settlement and of fixed values until much more progress has been made in the crowded and improved parts of the city.

No estimate of the result of that part of the work thus far done can be fairly made which does not take into account its unfinished condition, even in the second section, where work was first started and where most progress has been made. The adopted plan for this section proposes a network of lined and covered canals, enlarging in section and converging until they are all united on St. Louis street, delivering their contents at the intersection of Broad to a pumping station, which will, in turn, transmit them either to pumping station No. 3 or 7. The canals are completed and ready to do good service, but, in the absence of pumping station No. 2, can render but a small part of the relief for which they were designed and of that which surely may be expected of them in the future, when No. 2 will deliver its accumulated runoff through an unobstructed canal to No. 3 or No. 7, which will then, in turn, pass it to a final outfall.

The same is true of the first section, extending from the upper line of the city down to Julia street and the New Basin Canal. Here only about one-half of one of the three systems of collecting canals projected in the section has been built, but the pumping station to which it is tributary is in the same condition as No. 2. When the collecting and transmitting drains and canals, and the two pumping stations designed in connection with them, are completed, with such attendant improvements as will be shortly mentioned, there is every reason to expect a realization of the benefits held out by the plan which the commission is following.

CARELESSNESS AND WANTONESS.

It would be improper to leave this part of the subject without reference to the abuses of carelessness and wantonness to which the work is subjected, and which should form the subject of the most vigorous municipal action. Already piles of ashes and other heavy refuse are found in the conduits. The grating of catch basins and drains are intentionally broken or stolen. As many as twenty-two are already stolen on Third street, the last finished work. Drains are choked with a most remarkable collection of garbage and trash. Added to this is the careless and unsightly deposit of paper and sweepings in the gutters, which, if not peculiar to, is excessive in New Orleans.

It should also be mentioned that in certain cases the conduits are obstructed to a greater or less extent by water or gas mains, the removal of which neither the city nor Drainage Commission has as yet been able to secure. The most flagrant instance of this is a 30-inch water main crossing the Camp street conduit near the corner of Canal, occupying quite half of the waterway. This should, and no doubt will in the near future, be removed.

All these obstructions are remediable. There are others which are natural here and must be accepted as inevitable. Amongst them may be mentioned the immense collection of leaves at certain seasons in the gutters of our tree-bordered streets, and the profuse mat of water hyacinths covering the canals. All these nuisances will limit, to a certain extent, the service which any system can render until they are abated by vigorous legislation and policing.

Another obstacle to the full and immediate realization of the results of the drainage was recognized by the Advisory Board when the paving of streets and grading of gutters was given the fourth place in the order of procedure in construction. While an absolutely necessary adjunct to successful drainage, paving is not strictly a part of the system. It is kept apart, left in the hands of the public, and is dependent for its progress on the prosperity and enterprise of the community. It is to be expected that the complete result of the plan of drainage will be available, not when each and every canal and pumping station is finished, but only when the streets are properly graded and paved and connected with the con-

duits. Observations which can be made in any rainstorm on the fragments of the conduits already built afford clear illustrations.

If the Camp street conduit had the capacity of the Mississippi river it could not drain parts of Poydras street towards the front, with the paving in its present condition. The St. Charles avenue conduit can be observed to run only partly full, with ample catch basins wide open and running freely, while many of the streets extending towards the river are badly overflowed. The water simply cannot reach the conduit rapidly enough with the streets in their present condition, and never will until they are improved. Of course, in the unpaved portions of the city the situation is at its worst. No amount of conduit construction and pumping will promptly relieve from overflow a part of the city intersected with mud streets, badly cut into ruts, with unlined and grass-grown gutters, and a fall of two inches to the block. If the projected canals were excavated through the absolutely flat area between the Metairie Ridge and Lake Pontchartrain, no relief would be experienced until the landowners had thoroughly ditched their lands to allow the runoff to reach the main drains.

Accompanying the plan of the Advisory Board was an estimate. Its details and the explanatory text of the report show clearly what was included. It amounted to $7,933,000.

The money paid and pledged under contracts by the Drainage Commission now amounts to $4,327,300. Of this, the sum of $523,860 has been applied to objects which were not included in the estimate, but were accessory charges, as necessarily accompany any great work. It includes the following heads: Interest on bonds, paving streets, cleaning old canals, repairs to old drainage machines, covering canals on neutral ground streets, expropriation of right of way, legal charges, and office and engineering expenses.

The balance left, $3,803,436, has been applied to objects included in the estimate of the Advisory Board. While the sum thus spent is less than half of the estimate, the work done and paid for and now under contract is far more than half of that included in the estimate. A statement of it has been hereinbefore given. It includes a central power station, completely erected and with half an installation; of six pumping stations out of eight,

completely erected and with half installation; and much more than half of the total length of projected lined and covered canals.

With this statement of its proceedings, the Drainage Commission claims that it has substantially followed the plan adopted, making but small use of the authority of change granted it by the organic law; that the funds intrusted to it have been carefully and economically administered, and the results obtained in work done, bear a full proportion to the part of the estimate of the Advisory Board which has been at their disposal, and that if the remaining funds are insufficient to complete the work, it has been made so by causes over which they have had no control.

It is claimed that the usual precautions have been taken in these contracts, and that all the parties with whom they have been engaged bore a high character for ability and solvency.

Barring the matters now in controversy, the work has been performed in a satisfactory manner, with good material and workmanship. It is claimed further that, from any evidence shown by the work, in its incomplete condition, there is no reason to doubt but that the plan will furnish all relief that could reasonably have been expected, in proportion to the extent to which it can be carried by the funds available.

The commission has adopted a method of settlement of its controversy with the National Contracting Company, which, it is believed, will lead to a prompt and just conclusion. The character of the engineers who have been called in consultation insures a just regard to the rights of all parties, and a settlement, closing all controversy and leading to the prompt completion of all unsatisfactory and unfinished work.

EXHIBIT "I."

WIDTH OF CANALS.

FIRST SECTION.

STREET OR AVE.	LOCATION.	APPROXIMATE LENGTH, FEET.		APPROXIMATE WIDTH, FEET.	WIDTH AS CONSTRUCTED. FT.	IN.		FT.	IN.
Third	Claiborne to Liberty	Unpaved,	2,500..	Covered, 24..	20—	0	TO	18—	8
Third	Liberty to St. Charles	"	2,100..	" 20..	18—	0	"	16—	0
Third	St. Charles to Constance	Gravel,	2,800..	" 15..	*11—	0	"	10—	0
Constance	Toledano to Third	Unpaved,	2,650..	" 9..	* 7—	0	"	5—	0
Constance	Felicity to Third	"	3,500..	" 8..	* 8—	0	"	5—	0
St. Charles	Toledano to Third	"	2,100..	" 5..	6—	0	"	5—	0
St. Charles	Felicity to Third	"	2,600..	" 5..	6—	0	"	5—	0
Nashville	Robertson to Pitt	"	3,770..	" 15..	*13—	0			
Nashville	Pitt to Constance	"	2,100..	" 12..	*12—	6	"	8—	6
Perrier	Nashville to Park			"	* 5—	0			
Perrier	Nashville to Soniat			"	* 7—	0	"	5—	0
Constance	Audubon Park to Nashville	"	2,600..	" 4..	* 6—	0	"	5—	0
Lowerline	Jeanette to Oak	"	1,100..	" 12..	*10—	0			
Lowerline	Oak to Pearl	"	2,500..	" 10..	* 8—	6	"	8—	6
Lowerline	Pearl to Wall	"	3,000..	" 6..	* 7—	0	"	5—	6
Wall	Park to Lowerline	"	1,200..	" 4..	* 5—	0			
Pearl	Burdette to Lowerline	"	1,500..	" 1..	* 5—	6	"	5—	0

* Vertical wall.
Widths are given at flood line.

WIDTH OF CANALS.—Continued.

SECOND SECTION.

STREET OR AVE.	LOCATION.	APPROXIMATE LENGTH, FEET.	APPROXIMATE WIDTH, FEET.	WIDTH AS CONSTRUCTED.				
				FT.	IN.		FT.	IN.
Julia	Baronne to Camp	Square Block, 1,225	Covered,	8	10—	4		
Julia	Camp to Constance	" " 700	"	8	9—	0 to	8—	1
Constance	Julia to Howard avenue	Unpaved, 900	"	6	6—	8 "	6—	0
Orleans Relief	Pumping Station No. 2 to Pumping Station No. 7	" 12,300	Open,	60	45—	0 "	60—	0
Orleans Outfall	Pumping Station No. 7 to Lake Pontchartrain	" 10,000	"	60	60—	0		

THIRD SECTION.

St. Bernard	St. Charles to Claiborne	Cobble, 3,150	Covered,	12	*13—	0 to	10 —	0
St. Claude	Frenchmen to St. Bernard	Cobble, 1,050	"	1	* 6—	0 "	5—	0
St. Claude and Rampart	St. Peter to St. Bernard,	Cobble and Square Block, 3,300	"	6	* 8—	6 "	5—	0
Claiborne	Esplanade to St. Bernard	Neutral Ground, 1,500	"	4	* 6—	6 "	5	6
Claiborne	Elysian Fields to St. Bernard	" " 2,600	"	4	* 6—	0 "	5	6

* Vertical wall.

Widths are given at flood line.

WIDTH OF CANALS.—Continued.

FOURTH SECTION.

STREET OR AVE.	LOCATION.		APPROXIMATE LENGTH, FEET.		APPROXIMATE WIDTH, FEET.	WIDTH AS CONSTRUCTED. FT.	IN.	
Lafayette	Claiborne to Broad	Unpaved,	4,400	Uncovered,	20	40	0	Open
Claiborne	Elysian Fields to Lafayette	"	2,700	"	4	20	0	"

FIFTH SECTION.

Jourdan	Claiborne to Broad	Open,	4,500	Uncovered,	20	40	0	"
Jourdan	St. Claude to Claiborne	Unpaved,	4,800	"	15	35	0	"
Claiborne	Independence to Jourdan	"	4,200	"	4	20	0	"
Claiborne	Adams to Jourdan	"	4,000	"	4	20	0	"

ALGIERS SECTION.

Eliza	Powder to Valette	Unpaved,	1,700	Covered,	4	* 5	0	Covered
Valette	Eliza to Newton	"	2,000	Uncovered,	7	* 7	0	"
Valette	Newton to Lapeyrouse	"	1,100	"	9	*10	0	"
Lapeyrouse	Valette to Canal Avenue	"	2,700	"	10	30	0	Open
Canal Avenue	Lapeyrouse to Pumping Station	"	1,300	"	15	30	0	"

* Vertical wall.
Widths are given at flood line.